JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES.

Coal Miners and their Wages.

FROM the very beginning of the great coal "boom" in the autumn of 1899, when the wages of the coal miners commenced the upward journey that eventually landed them at a level never before dreamed of by the men, we have foreseen the possibility of serious trouble accompanying the return of wages to normal rates, especially during the last stages of that return; and the districts in which trouble has been most to be anticipated are those comprised in the Miners' Federation of Great Britain, and the allied Federation of South Wales Miners. The leaders of the Miners' Federation have been the most aggressive in their speeches, evidently mindful of the altogether unwarranted support they received from the public in the big struggle of 1893, and strengthened in their pugnaciousness by knowledge of a big balance at the bank. The boastful and warlike speeches delivered by Mr. Pickard and his colleagues, the past year or so, have evidently not been without effect upon the individual miners—who are more apt than some of us to take Mr. Pickard quite seriously; for, contrary to expectation, and also to the advice of the several delegates, the general body of miners belonging to the Federation have refused to consent to the reduction of wages (from 60 to 50 per cent. above the 1888 standard) which their representatives on the Conciliation Board agreed with the employers' delegates the other day to recommend their respective constituents to adopt.

The only result of this refusal of the men to ratify the proposed reduction will be that the matter will be referred to the Arbitrator appointed by the Board in case of difference—viz., Lord James of Hereford—for it is improbable in the extreme that if, as is certain, Lord James decides that the reduction is reasonable, the miners will go to the length of throwing over the Conciliation Board altogether, and striking against the reduction. But the refusal of the men to endorse the agreement of their representatives in regard to a reduction which will still leave wages at 50 per cent. above standard, as compared with the maximum of 45 per cent. originally fixed when the Conciliation Board was constituted after the great strike, is very significant, and bodes ill for a peaceful settlement when it comes to a question of reducing wages to the minimum of 30 per cent. above standard, which is bound to arise within the next two or three years, at the very outside, while other reductions must be made before then. It is a very great pity that the coal-owners ever agreed—as, at the zenith of the "boom," they did agree—to modify the original terms as to the maximum wage; for the whole principle of raising wages substantially because the market conditions happen to increase temporarily the price of coal, is radically unsound, seeing that the greater profits thereby accruing to the owners are not due in the slightest degree to better working, zeal, or intelligence upon the part of the men. Coal miners' wages should be regulated by the state of the labour market, not the state of the coal market. If, then, a plan could be devised, by which the men could participate in profits in proportion to economies effected by them in the working of the collieries, well and good. But the present system is a never-ending source of friction, and has no relation whatever to the principle of profit-sharing.

Coal miners are, as a body, like a lot of spoilt children. Their leaders always speak as if miners were, and the public has come to regard them as, a class of men entitled in every way to special consideration. This is perhaps due to the fact that public sympathy has, quite naturally and properly, been excited at times—now, fortunately, more rarely than formerly—by the terrible calamities that have befallen coal miners through explosions, earth falls, and other accidents connected with their work. But, as a matter of fact, there are other occupations in which the risks of personal injury are practically as great—the service of railway companies, for instance—but in which the loss of life is not attended by circumstances which attract public attention and sympathy, as it is attracted in the case of a colliery disaster. The fact that, in consequence of the special circumstances connected with their calling, Parliament has specially legislated for their protection, has also tended to the "spoiling" of the miners as a body. The result of this spoiling of the men is that no great industry is more disturbed by labour troubles than that of coal mining; and, of course, no industry is more disturbed by labour troubles in the coal mines than that of gas making. Gas managers will do well, therefore, to keep their "weather eye" open for some time to come, and to keep that eye particularly vigilant as regards the course of events in the South Wales coalfields during the next few months. The sliding-scale agreement expires at the end of this year; and, with the litigation arising out of the "stop-"day" policy pending, relations between masters and men are by no means cordial. We all hope very sincerely that the trade may pass through the labour difficulties that beset and lie ahead of it without serious trouble, and we have no desire to be pessimistic; but it would be foolish in the extreme for those who, like gas managers, are so nearly affected by such troubles when they do arise, to ignore or leave out of account the existence of elements that may possibly lead to serious disturbances of the peace.

Labour Candidates for Parliament—The Gas-Workers' Union Selection.

IT is only what was to have been expected, that the highly significant proceedings in Parliament discussed in these columns last week—when a resolution amounting to a reflection on the High Court of Justice for having given judgments displeasing to Trade Unionists was only defeated by 29 votes—should already begin to show other effects. The wire-pullers of the fighting Unions have lost no time in taking a fresh cue from the manifest limpness of such a large proportion of the members of the existing House of Commons, and are laying plans to the best of their ability for doing better in the same arena next time. Nor are they to be blamed for this. It is an axiom of experienced critics of democratic forms of Government, that "the tools "fall to the hands of those who will use them;" and if organized Trade Unionists, or publicans, or any other sufficiently numerous and influential section of voters, are alert enough to use the machinery of popular election to their own advantage, it is idle for those who do not agree with them to complain of the proceeding. It is equally open to all voters to organize, and to seek their own ends by constitutional means; and the only proper and effective way of fighting out an electoral issue is to meet energy with energy, organization with organization, influence with influence. The recent vote of the House of Commons has inspired the Gas-Workers' Union, meeting last week in Manchester, to make a fresh bid for legislative power, by putting up Mr. Pete Curran for Jarrow-on-Tyne, and to finance him in his candidature.

Mr. Will Thorne is already the Union's candidate for South-West Ham; so that here is the first answer to the feeble resistance of gentlemen of the House of Commons to the Trade Union impeachment of the "Judge-made law," that such bodies shall be held accountable for their wrongful acts. It is to be hoped that honourable members like the prospect. For, irrespective of party politics, unquestionably at future elections candidates will be asked for pledges on this head; and in many constituencies the contingency of having to choose between respect for the law, and regard for a solid vote of a phalanx of nose-led Trade Unionists, will try the nerves of the opportunist politician. Yet the issue will be safer if the rights of the matter are only perceived beforehand. The so-called "Labour" candidates, whatever their origin and backing, are negligible quantities. The few who get into Parliament find little to do, and invariably sink into the rating of "units" of one political party. The only dangerous members are the respectable but vacillating gentlemen who desire to be popular without having counted the cost. It is they who swell the division list on the wrong side when some plausible resolution, drafted in the presumed

interest of the working classes, is sprung upon the Legislature. Fortunately, in regard to the matter in question, working men's opinions are sharply divided. The Thornes and Currans are not everybody. There are also members of old-established Trade Unions with money in the bank—more money than the Gas-Workers will ever possess—who are not at all sorry to see a check put upon the quarrelsomeness of the professional agitator, who is usually far readier to spend the Union funds on brass bands and on personal expenses than he is to apply the resources of the Union to their proper objects. He is a poor parliamentary candidate who cannot play off one section of voters against another. A competent knowledge of the working, as well as the theory, of Trade Unionism, and personal experience of a strike, should form part of the equipment of every candidate for a constituency where the Trade Union vote is considerable.

Public Opinion of Cheap Gas.

THE instruction of public opinion is one of the chief duties of the more serious and responsible portion of the periodical Press of all countries; and there is not much reason to complain of the manner in which this duty is perceived and discharged by the best reviews, magazines, and newspapers published in the English language. The influence of the opinions thus created and led is manifested in divers places, more especially in Parliament and in the deliberations of the local government authorities, where the general information of well-meaning men who are not in any sense students must be trusted to rightly guide their decisions on proposals brought forward by professional advisers. It has been remarked here, on previous occasions, that perhaps the most disappointing of all specimens of periodical literature are the pretenders to the technical classification, which in point of fact are not technical. It is difficult to allow any reason for the existence of these periodicals. Yet somehow they do exist; and, unfortunately, they do more harm than good by their uncritical dissemination of downright rubbish and lumber in the guise of information. It would be easy to name examples in the province of engineering—well got up, excellently illustrated publications, which nevertheless no expert in the specialities they affect would take seriously for a moment.

We find somebody occasionally writing in these periodicals upon such a subject as the smoke nuisance of British and American towns, and proposing, as though it were an entirely novel suggestion, that gas companies should supply a "cheap gas," which might supersede coal-fires. Those who have the smallest exact knowledge of the subject are weary of the term "cheap gas." What is it that the gas industry exists for, if not to supply this very want? It is as though a wiseacre should contend that the great need of the country is cheap telegrams, cheap railway transport, and cheap steamboat carriage. Of course, all this is obvious—as obvious as Mrs. Micawber's profound observation respecting the kind of cure required for her husband's chronic pecuniary complaint. And yet all this superfluous *pseudo*-technical writing is encouraged in the pretended technical periodicals which encumber the tables of free libraries, to the confusion of counsel and the wasting of readers' time. We do not find the leading engineering journals devoting their space to the ventilation of general aspirations after cheap railway charges. Their conductors know full well that anything which will lengthen the life of railway metals is more to the point than any quantity of this paltry writing. Yet it goes on, and the "popular technical" Press is always full of it, to no good purpose whatsoever.

By the same reason, it is impossible for the "JOURNAL" to notice and deal with the "elegant extracts" from newspaper articles and letters relating to "cheap gas" to which our attention is continually being drawn. Nevertheless, we rejoice when people whose interest in gas is mainly, or solely, that of consumers, are found publicly discussing from their own standpoint the question so intimate for themselves of what sort of gas they like, and think they ought to have for their money. So long as they do not fall into the weakness of dogmatizing on the matter, they may contribute towards the formation of a healthy interest in the subject. But the danger is that just at this stage these inquirers are very likely to meet with some pretended technical treatment of the question which puts them all wrong. It is extremely difficult to uproot an error implanted in this way. Only the other day we came across a magazine plea for "cheap "gas" to supplant the smoky domestic fire, which was desperately maltreated elsewhere by a would-be technical critic, whose one idea was that cheap gas means water gas. "Cheap gas," said he, "is so deadly a poison that its regular "use would require very special safeguards. Already, we "believe, cheap gas, enriched, is sent out to London gas "consumers. Its principal constituent is carbonic oxide "—a gas which is not only a deadly poison, but of which "even small quantities have powerful anæmic effects." It is difficult for the ordinary public to pick a safe course amid a multitude of advisers so muddle-headed as this self-appointed teacher.

Electrolysis of Mains—Fresh Evidence and Views.

THE remarkable communication from Mr. Wood, of Bradford, which is noticed in another column, will serve as a further provocation to those who are charged with the responsibility of safeguarding the interests of the gas industry, to give heed to the danger of electrolysis. It is the most formidable piece of evidence that has yet been forthcoming in the United Kingdom as to the existence of the new risk of fire, explosion, and destruction of gas distributing plant which is referable to the action of stray electric currents. It can only have been by a fortunate accident, the repetition of which is not to be relied upon, that no disaster resulted from this particular work of destruction. The necessity for drawing attention here to this topic, which is also mentioned in our "Electric Lighting Memoranda," illustrates very pointedly the importance to both technics of this tangent of gas and electricity distribution systems. It is impossible to keep apart the interests so strikingly entangled in this particular; and we are glad to know that many of the highest authorities on the electrical side are just as concerned as gas engineers can be to find a remedy for this mischief before some terrible casualty arrives to overwhelm both industries in a common trouble. It is not only electricians and gas engineers who are taking cognisance of the danger. The current issue of the "Builder" contains some pertinent observations upon it, which go to show that other eyes are watching the matter curiously, and with not a little apprehension of future evil.

As our building contemporary justly points out, it is the electricity distributing plant in London itself that has of late drawn attention, by outbreaks of fire and street explosions, to the fact that the working of the ordinary direct current systems of distribution are far from perfect. Attention has repeatedly been called to the extremely low insulation resistance of some of the older networks, which constitutes a danger in connection with their continued expansion of duty in use. The newer mains have been better insulated; but, unfortunately, this higher insulation has only been secured in many cases by embedding the mains in inflammable substances which are capable also of giving off explosive gas when heated. "During the last winter, it has been a common experience "for Londoners to see the roadways torn up for a distance "sometimes of 50 yards, and to see numerous workmen "taking out charred mains and putting in new ones with "commendable rapidity." The extension of the Charing Cross Company's system into the City has been marked by many untoward incidents of this nature, the lesson of which cannot be neglected. When rival electricity distribution systems begin by attacking each other, and breaking down their own feeders, the mischief is not likely to remain a domestic one. This applies to lighting currents only, which are comparatively small in quantity, and are more or less thoroughly accounted for. It does not touch the more serious consideration of traction currents, which are vastly more potent for evil, and waste far more lavishly.

A writer in the "Electrical Times," professing to give American views of the conditions of electricity distribution prevalent in England, roundly accuses his British colleagues of stinting copper. He declares that the proportion of the distributing network which is pure copper (the conductor), is usually ridiculously small. On the other hand, the large proportion of the capital investment on mains which goes in insulation, lead, and deep ditching, is absolutely lost from the beginning. All this part of the cost is irrecoverable, and out of reach. Consequently, when such mains and feeders get overloaded, it means "an awful job." The critic does not wonder that the present race of electricians have tried to pass it on to their successors by changing to 200 volts. "All this solid construction, all this deep ditching, this iron "troughing and asphalt filling, cost money—an appalling "lot of money. And the whole blamed thing is to do over

"again when you want a new feeder!" The American plan is to lay in the first place plenty of common drain-pipe conduits, and put in the copper where it can be recovered if wanted, or added to at need. This method is not recommended for copy, but only as an example of the principle. Of course, there are gas explosions sometimes; but these are to be prevented by care and ventilation. And there is also electrolysis; but the critic offers the comfort that the best known prevention of electrolysis is a dry soil. "You "cannot have electrolysis in dry soil; and nothing gets and "keeps soil so dry as good sewerage and waterproof paving. "Those concrete foundations hermetically sealed pavements "of yours are doing more to prevent electrolysis than all "the regulations. They keep the rain out of the soil, and the "sewers continue to drain it until it ceases to be an electro-"lyte. That is experience; not merely theory." It is well to learn all there is to be known on the subject.

It is, however, not very reassuring to hear from the same quarter that the tendency of British electricity distribution for lighting is towards the use of yet higher voltages. The observer concedes that English electricians are not going back to the 100 volt distribution which satisfies the American practitioners; but he warns them that unless they alter their hand they will find themselves, one of these days, "hunting "for excuses to use 400 volts." This is something to ponder over. Meanwhile, it would appear that if, as is asserted, English electricity supply is actually below the highest standard of excellence attainable in the technic, by reason of the skimping of the copper, then innocent sufferers from this error ought not to be victimized through this particular default.

Expensive Incandescent Mantle Licences.

We appear to have been mistaken in supposing that it was now clear to all who have any interest in the matter that there is no difficulty whatever in the way of procuring licences which will enable the holders to deal, within the terms of the document, in mantles—on the one hand as suppliers, and on the other as large users. In order to give them the utmost freedom, Mr. Livesey has suggested that gas undertakings would do well to take up a licence which will absolve them, if they purchase outside the associated makers (the number of whom is yet extending), from any unpleasant consequences. All that gas undertakings have to do is to communicate their desire to take up a licence to Mr. Frank Bush, of the South Metropolitan Gas Company, or direct to the Welsbach Company, and then, after the formal completion of the documents, to merely comply with the conditions of the covenant they enter into, the terms of which were published in the "Journal" for April 29.

In the incandescent mantle trade, there seems to be a pretty general ignorance as to the method to be adopted in applying for a licence, and as to the expense incident to the application. The whole process is very simple. All that need be done is to write to the Welsbach Company; and so far as they are concerned, there is no expense whatever attached to the granting of the licence. All the trading licences are drafted in the same terms; and therefore there is no necessity for agents in the matter. Agents cannot do more for the mantle trader than he can do on his own account, and evidently very much cheaper. It is right that this should be as widely known as possible, because we have in hand a copy of a promissory note which members of the mantle trade have received for signature, and which places at the modest figure of £100, on account of each licence, the recompense to certain persons for the "time, "trouble, and expense" incurred. The document runs: "In consideration of the time, trouble, and expense you have "incurred in our behalf in or about the obtaining of a licence "herein upon terms which have been discussed, we hereby "agree to pay you the sum of One Hundred Pounds sterling, "the said sum to be paid by us immediately upon our or our "solicitor receiving from the Welsbach Incandescent Gas-"Light Company, Limited, the said licence duly signed on "their behalf." It is needless to say that the note promises payment of the £100 to the persons who issued it. Without passing any comment on the document, we will leave it and the mere statement of facts as to what can be done and what need not be done in procuring licences to speak for themselves. Now that attention has been called to the matter, if mantle suppliers and dealers choose to go to any unnecessary expense, it will be their own affair and not ours. It is, however, a pity that the Welsbach Company's Board do not insist on direct application for licences being made to them by the trade.

After the foregoing had been set, a letter was received from Mr. George Livesey, in which he states very clearly the advantages which gas undertakings secure by entering into an agreement with the Welsbach Company. The letter appears in our "Correspondence" columns, and a perusal of it, we think, will satisfy most gas managements as to the advisability of signing the agreement. The more agreements there are in existence in the gas industry (even if unexercised), the stronger will be the position of gas undertakings in maintaining the prices of mantles at a low level. This is a point that most people will recognize without any further explanation.

The Circular of Inquiry Again.

It should be high time for the cessation of the nuisance of the inquiry circulars directed to such purposes as that which may be surmised to have actuated the Halifax Corporation Gas Committee, and induced Mr. Holgate, the President of the Institution of Gas Engineers, to consent to the distribution broadcast of the formidable examination paper which we publish elsewhere to-day. It has been sent to the office of the "Journal" by one of the recipients, accompanied by a protest which appears to be entirely merited. If the head of the Institution of Gas Engineers cannot get along without worrying utter strangers in this particular manner, then the resources of modern professional men compare badly with those of a past which we are accustomed to look back upon as comparatively dark. Are there not Board of Trade returns, technical societies, and published papers and statements enough for the instruction of the municipalized gas manager in the ways of the technical world, that he should become a common suppliant for outdoor assistance in this shape? All the statistics in the universe are worthless without intelligent handling; and but little intelligence would have discovered the futility of this Halifax proceeding. If Mr. Holgate was overruled into making himself a party to this particular circular, he is to be commiserated upon his environment; if it was an idea of his own, inspired by a thirst for statistical information, then it is not putting it too strongly to say that he ought to have known better. There was no need to trouble anybody to reply to most of the questions. They might have been answered from published statistics. And there is no reason why any man, not being a personal friend of Mr. Holgate's, should take an instant's trouble to write out answers to the rest. We have often observed before in these columns, that people now-a-days seem to forget that it is as great a liberty to write to a stranger without adequate excuse, as it is to speak in the street to a person one has never seen before. If this is a point in the code of manners, how much greater is the affront in addressing a stranger a demand to know all about his business, and, by intention, to suck his brains? Wherefore, we stoutly counsel all recipients of these unwarrantable communications to consign them to the waste-paper basket. The best-informed engineers never condescend to so objectionable an expedient. We could name the first dozen men in the gas engineering profession, straight off, and go bail that not one of them ever sent out a general circular of inquiry. The custom is an abuse of distinctly modern growth, and anything but elevated origin; and it should be strongly discountenanced in the best interests of the gas industry.

Municipal Financing at Southampton.

It will be seen, by the report which appears in our "Legal "Intelligence" to-day, that the Corporation of Southampton have lately had a severe rebuff at the hands of the Lord Chief Justice and his two colleagues in a King's Bench Divisional Court. We record the incident at what may be regarded by some of our readers as unnecessary length, in order that the lesson it conveys may be brought home to other corporate bodies, who may thereby be saved from the ignominy of suffering defeat at the instance of a persistent ratepayer with a keen eye for his fellow-townsmen's interests, and be enlightened upon certain points of municipal law which appear to have been rather obscure. The electric light undertaking at Southampton has not been a very money-making business, and the Corporation have found themselves gradually getting into arrear with their accounts,

which, as the Lord Chief Justice put it, have gone "from "bad to worse;" the result being that the assistance of the bankers had to be sought to enable them to clear off their indebtedness. The next step was to raise a sum of £96,000 by means of a district rate, levied over the entire area of the borough, which was extended not very long ago by the inclusion of some adjacent parishes. The legality of the whole proceeding was disputed, as a ratepayer, by Mr. C. Crowther Smith, the Secretary of the Southampton Gas Company, on the ground that the indebtedness which was to be liquidated by means of the rate was incurred for work done beyond the retrospective limit of six months allowed by section 210 of the Public Health Act, 1875; and he took proceedings at Quarter Sessions to have the rate set aside. The Recorder gave judgment in his favour, but stated a special case for the opinion of the High Court, who unanimously upheld it.

Lord Alverstone confessed to being impressed by the argument of Mr. Macmorran, who appeared for the Corporation, to the effect that the accumulated back debts were absorbed in the debt to the bankers, and that it was to meet this that the rate was raised; but he thought that if such a line of reasoning were allowed to prevail, public bodies would be able to "get round" the provisions of the above-named section altogether. He considered there was evidence before the Recorder, of whose judgment he spoke in high terms, which justified him in coming to the conclusion that the Corporation were paying their old debts out of the moneys to be raised by the disputed rate. So satisfied were the Judges with it that they did not trouble Mr. Foote, who represented the appellant, to address them. A second point arose upon the construction of the Provisional Order relating to the extension, and the limitation of certain charges to the old borough; and on this also the decision of the Recorder was confirmed. The result was awaited with keen interest, and was naturally received with much gratification by the inhabitants of the localities specially concerned. The effect will be to relieve them of taxation at the expense of the residents in the old borough; but the burden was an illegal one, and therefore they were justified in trying to throw it off. Their thanks are due to Mr. Crowther Smith for the great services he has rendered in this matter; and we are pleased to find that suggestions have already been made for recognizing them in some public way.

Begging for the Beanfeast.

THE season has arrived when the fancy of employees in gas-works and other places of unremitting toil lightly turns to thoughts of beanfeasting. This is all very well, and nobody grudges these sons of labour their annual outing. But there are, in some instances, unlovely features attached to the function—excrescences, so to speak, which might with advantage be excised. We have received a copy of a circular application emanating from a Corporation Gas Office, which shall be nameless for the nonce, that was sent to a firm of manufacturing engineers and contractors, asking in form for a subscription, "as in former years," towards the expenses of the Workmen's Annual Excursion. The letter-paper bears the arms of the town, and requests that cheques should be sent to the signatory, at the Gas Office. We are assured that this is not an exceptional case; but the whole thing is so scandalous that we shall heartily try to suppress it. It is high time that beggars flaunting corporation arms were shamed out of their mendicancy; and we hereby engage to lend the assistance of the columns of the "JOURNAL" to any recipients of these begging letters who desire deliverance from such blackmail. If in future we receive such a number of these circulars from firms trading with gas-works as shall warrant us in taking the step, we shall publish them in full, with the names of the senders attached.

It is only too notorious that this kind of thing goes on to a shameful extent, and that firms are fain to submit to it in the imagined interests of their business. They know that meters fail to work, paint proves unserviceable, where the goodwill of certain jacks-in-office is not purchased. It will be their own fault if this evil is not suppressed. This is an aspect of the question of traders and gas workers of every degree which nobody can defend. The heads of concerns owe it to others as well as themselves to preserve their independence of character from the insidious influence of the bestowal and acceptance of alms in any shape; and it is not to be doubted that proved delinquencies of this kind will everywhere and always bring down the sharpest punishment from superior authority. Once let the corporation of an English town, or the board of directors of a gas company, see their official cognizance degraded by being used at the head of a begging-letter, and the consequence to the perpetrators and abettors of the offence can be safely left to the imagination. Wherefore, whatever the excuse derivable from custom, let it be stopped. Gas workers are not so ill-paid that they need go cap-in-hand to others who equally have their living to earn, for the wherewithal to enjoy themselves decently.

The Incidence of Duties on Commodities.

ALTHOUGH the new import corn duty does not specifically concern us here, the disputation on its incidence is interesting for those—among whom our readers were included—who about the same time last year were arguing as to who would pay the export duty on coal. It is not a little ironical that such a double-action conundrum should be put within the short space of twelve months to professed political economists, and especially to self-styled Free Traders, whose opinions have generally proved unequal to the strain of justifying two contradictory prejudices. When a man says he objects to duties *in toto*, he is at least intelligible. One may even sympathize with him; and sigh for life in a region where all the benefits of civilization might be enjoyed for nothing. But when another person declares his objection to both export and import duty, on the ground that they will come out of the same pocket, it is somewhat difficult to follow him. It is, unhappily, the universal experience that nations cannot pay their way without levying taxes and duties, payment of which is as odious to the individual as it is necessary to the community. There is much to be said for the wisdom which merely shrugs its shoulders and pays, without questioning where the money comes from. But to the curious economist by profession or predilection, the question of the ultimate incidence of a duty must always be a fascinating problem—all the more so, indeed, because there is no agreement on the point among the doctors. Perhaps the tentative observation on this head of Mr. Austen Chamberlain, who had doubtless been fairly well coached, is as sound as any. He said that, probably, when the supply at the ruling price of the day happens to be greater than the demand, the duty on a commodity is borne by the seller; while when the contrary condition prevails, and the demand is ahead of the supply, the duty is paid by the buyer. It is an explanation that sounds reasonable, and obviously applies both to exported coal and imported corn. At any rate, the highest living authorities on the science of political economy have not disputed it.

Maintenance by the Gaslight and Coke Company.

It will interest many of our readers to learn that the Gaslight and Coke Company have adopted a scheme of incandescent burner maintenance. It is to be very much on the lines of the Welsbach Company's plan, which we described in the "JOURNAL" for Feb. 11 last, p. 340. The rate of charge, however, will be 9d. per burner per quarter, with a minimum of 3s. per quarter per consumer. The Welsbach Company's charge at the time of the article referred to was 6d. per month; so that the Gaslight and Coke Company's terms are more favourable to the gas consumers if the latter are to get an equal amount of attention as under the Welsbach scheme.

Prospective Welsbach Prices.

The new Board of the Welsbach Company have been very circumspect regarding the arrangements for the lowering of the prices of their goods. It was a judicious move on their part, for example, which gave the large buyers of Welsbach mantles and burners three full months' notice of the coming reductions; and now more than five weeks before the revised prices are to take effect, they have placed the new price list in buyers' hands. This is very considerate, as it will enable all concerned to give out their orders betimes, and make other arrangements for the fresh conditions of business which come into force on July 1. The new list which has been circulated by the General Manager (Mr. K. H. Buchanan) shows that to the trade for the mantles of various denominations—ranging from the Cx, through the Kern series up to No. 4, to the "Gem" mantle—there is to be a uniform price. Under 35 gross lots, the

charge will be 4½d. per mantle net; and 35 gross lots and upwards, 4¼d. Although not mentioned in the list before us, gas undertakings, we understand, will be able to purchase 70 gross lots of mantles at an average price of 4d. each. The retail price is listed at 6d. net. The ordinary burners are coming down very substantially. Taking the "York" burner first, it is seen that under 1 gross lots will be purchasable at 1s. per burner; 1 gross lots and above at 11d.; and 4 gross lots, at 10½d. For the same burner with bye-passes, the figures are respectively 2s. 3d., 2s. 2d., and 2s. 0½d. For "C" burners and the same quantities, the prices are 1s. 5d., 1s. 4d., and 1s. 3d. each; and with bye-passes 2s. 10d., 2s. 8d., and 2s. 7d. Turning to the Welsbach-Kern burners, the prices for the No. 2 class, and the same lots, will be 2s. 3d., 2s. 1d., and 2s. apiece; and with bye-passes, 3s. 6d., 3s. 4d., and 3s. 2d. For the No. 3 size, the figures will be 2s. 10d., 2s. 8d., and 2s. 7d.; and with bye-passes, 4s., 3s. 9d., and 3s. 8d. For the No. 4 size, 3s. 6d., 3s. 3d., and 3s. 2d. are to be the charges; and with bye-passes, 4s. 10d., 4s. 7d., and 4s. 6d. There are, it may further be remarked, to be no changes in the quality of the mantles or character of the burners—excepting such as may be produced hereafter in the way of improvement. As was mentioned a few weeks since, the Welsbach Company are entering the lists with quality rather than cheapness as their motto. At the same time, they have the cheap lines in Sunlight mantles and burners as their rear-guard.

The German Gas and Water Engineers' Meeting.

As will be seen from the announcement appearing in our "Technical Record" to-day, an attractive programme has been prepared for the meeting next month of the German Association of Gas and Water Engineers. Herr E. Beer, the Manager of the Berlin Municipal Water-Works, is the President (this being his second year); and among the contributors of papers is to be found the name of Dr. Bunte, of Carlsruhe, who is to read what will no doubt prove an extremely valuable communication on "Gas Purification." The gas, water, and electric light industries are all catered for in the papers to be submitted; and generous provision has been made for the entertainment of members and friends attending the meeting. Besides all this, the reports of the Committees appointed to investigate various questions will be presented by the respective Chairmen; and among these gentlemen we notice the familiar name of Herr W. von Oechelhaeuser, of Dessau, whose report will deal with the very important subject of "Technical Instruction." Doubtless a large number of English colleagues contemplate visiting the Dusseldorf Industrial Exhibition this year; and we trust as many as are able will so time their trip that they may be in the town at the date of the meeting (June 24 to 28). They may be assured of a cordial welcome at the hands of the members of the Association.

Contributory Negligence.

The best lessons no doubt come from personal experience; but nevertheless it is possible for observant people to learn a great deal from the misfortunes of others. We would therefore draw the attention of all whom it may concern to the unhappy fate that has overtaken the Bridlington Gas Company (with regard to a claim made by them against the contractor for sewerage operations now being carried out in the town), in order that others may not fall into the same error. The very nature of their undertakings, and the conditions under which they work, render gas and water companies peculiarly liable to be confronted with legal problems, and points of interest in this regard are constantly cropping up. For this reason, reports of such law proceedings as take place are of great value to those engaged in these industries; and it is always our endeavour to make readers fully acquainted with proceedings before the Courts in cases the circumstances of which are such that they might at some period arise in other quarters. The action brought last week in the County Court by the Bridlington Gas Company (and which is duly reported elsewhere) is of this character, and so should be carefully noted by those having charge of gas and water mains. In this case, the Company were aware that the roads were being opened for the purpose of carrying out drainage works; and yet they took no steps to protect their mains from damage—regarding it as the duty of the contractor to do everything necessary to this end. The result was that several breakages occurred, for which (as well as for the consequent loss of gas) the Company endeavoured to make the contractor responsible. It was, however, held that, in not taking steps to look after their own interests, the Company were guilty of contributory negligence, and that their claim must therefore fail. This decision may seem a little hard, considering that the Company's pipes were already in possession of the ground, for the disturbance of which they were not responsible; but there is no doubt that, had they been able to show that every effort had been made by them to ensure the safety of the mains, they would have been in a much better position to recover damages from the contractor for the loss suffered.

Licensed Mantle Makers

One by one the number of incandescent mantle companies are increasing with whom business can be carried on without buyers standing in awe of any puissant reminder coming along that the 1893 patent is still a living entity. In last week's issue it was announced that the Continental Incandescent Gas Company had become a licensee of the Welsbach Company, and would now carry on a free business in their own wares. The General Incandescent Company, Limited, and the New Export Company have also added their names to the list of licensed concerns, and will henceforth be in a position to enter freely into the mantle competition. Unless a mantle company hold a patent for a mantle which they are assured can stand the strain of an infringement test, there is no question that the taking out of a licence is the most prudent course, and the quickest way of ridding themselves of the trammelling restrictions to business which there must be when there is anything in the nature of a legal question overhanging their transactions. For anyone now to throw himself into a contest over the point as to whether the 1893 patent is valid or otherwise, when within a few years it will not matter to him a farthing whether it has been or not, would be like sinking pounds to save pence, and that, under the new order of things, is about all the good it would do in the end.

And Dealers.

But talking about these licences, there are some among the makers and suppliers of specially named mantles in this country who think the new arrangement as to the granting of licences is a little too elastic, and that it would have been fairer—referring to the trade only—if the right of taking out licences had been limited to makers and suppliers and not accorded to the dealers or general wholesale houses, whose greatest care is naturally to purchase only those mantles from which they can net the largest profit. The fact that they can obtain licences will, it is said, tempt them to import a cheap and indifferent class of goods direct from abroad; and in this way the very people who have hitherto been, and would under other circumstances continue to be, the best customers of the licensed makers and suppliers will forsake them. It is impossible to restrain a little sympathy with this view in so far as those suppliers are concerned who have been put to considerable expense in litigation; but we do not think they have really much to fear. There are the users of mantles to be reckoned with; and it may be confidently said that they will not long put up with rubbish. Under the terms of the licence, the inferior imported mantles would have to be sold at or above the agreed price; so that—the prices being practically the same—there would soon be a sifting out of the bad from the good. In our view, those in the incandescent trade who fear the breaking away of customers to new sources of supply will find that this will be only a temporary matter, and the large dealers and buyers will quickly see that it is to their interest to resume patronage of those mantles on which they can rely. Licensed makers who come out strongly into the field at once, with decent goods, at a reasonable price, are the ones who will build up a substantial business, and in whom customers will in the future have confidence. Something is said elsewhere on the question of the simple procedure necessary in obtaining licences.

Municipal Trading at Yeovil.

Some of the unfairness caused by municipal encroachments upon the domain of the private tradesman was touched upon in a brief discussion at the last meeting of the Yeovil Town Council. In taking over the gas-works from the Gas Company's hands, the Corporation have also taken over the

business of supplying stoves and fittings, and appear to have developed it with so much success as to excite the jealousy and hostility of tradesmen in the town, who contend that they are being deprived of a valuable part of their business. It is doubtful, probably, in Yeovil, as it is in many other places, whether this contention that the business ever belonged to them could be substantiated by the ironmongers and plumbers, who looked with such a jealous eye upon recent developments of the trade in gas fittings and stoves. If the gas-fitters had not so lamentably failed to rise to the full height of their opportunities, there would not have been such an enormous field to be exploited by the superior energy of gas companies and gas committees. Yet when all this is said, there is certainly something in the suggestion that definite limits should be placed to the area of municipal trading. There is an element of injustice in the employment of the resources of the community in developing a business which competes more or less with the private undertaking of individual members of the community. How difficult it is under present circumstances to prevent the extension of municipal trading was incidentally shown at Yeovil. Not only do the Gas Committee sell fittings of various kinds and erect them, but, to a certain limited extent, they are also dealers in coal. Here, again, comes in the complaint of unfairness—not this time on the part of the coal merchants, whose business is interfered with, but by persons who think that the facilities for obtaining cheap municipal coal, if they are to be enjoyed at all, should be shared all round. In the present state of the law, it is difficult to say what is or is not legal in these matters; but there can be no question as to the impropriety of individuals, and especially members of a local governing body, being allowed advantages that are denied to the general body of ratepayers.

Gas Testing Under Difficulties.

A good many qualifications are in the ordinary way necessary to enable one to satisfactorily undertake the testing of gas, or to judge if the operation is being properly conducted. But in one place at least it seems desirable that the gentlemen so engaged should, besides being good chemists, have a knowledge of prize-fighting. Those who have made a study of matters regarding the gas supply of Dublin cannot have failed to notice that the relations between the Gas Company and the Corporation are of an anything but harmonious character. Even they, however, can hardly have been prepared for such a tale as was unfolded a few days since before the Recorder of Dublin, when cross actions for assault were heard between the Corporation Inspector of Public Lighting and Gas Examiner and a clerk whose duty it was to represent the Gas Company while the tests were being carried out. Naturally there was some dispute as to the facts of the case; but it was apparently admitted that the Gas Examiner (Mr. T. J. Cotton) received upon his forehead the weight of a heavy mahogany-framed chair, as the result of an altercation between the parties. After a very long hearing, the Recorder decided that there were faults on both sides. He awarded Mr. Cotton £40, while dismissing the action brought by Mr. Brent, the Gas Company's employee. We learn from the "Freeman's Journal" that the cases "attracted considerable interest;" and it is devoutly to be wished that they may be the means of drawing the attention of the citizens generally to the very unsatisfactory nature of the relations existing between the Corporation and the Company. The Recorder said he hoped the parties would bear in mind that a teaspoonful of honey was worth a barrel of vinegar, and that these cases might have some "harmonizing effect." We hope so too; but it is evident that some of the remarks of Counsel for the Corporation, in the course of the hearing, will not tend to bring this about. Was it not unnecessary for Mr. Healy, K.C., M.P., to say "they knew that if they were to bring an action against "him [Mr. Brent] in the High Court, they would be only "throwing money away," and to suggest, when the Chairman of the Lighting Committee stated that he attended on a subpœna to give evidence for the Company, that "he may "supply, or hope to supply, them with coal?" The first of these accusations needs no comment; while the worth of the second will be fully understood when it is pointed out that the gentleman in question is not a coal merchant, but a paper manufacturer! However, in the extensive litigation between the parties, the Gas Company have hitherto always been proved to be in the right; and we are sure they will bear the Corporation no ill-will in consequence of the result of the present proceedings.

A City of Many Gas Companies.

To-day we report the proceedings at the meeting of the third of the Companies engaged in the work of supplying Buenos Ayres with gas—the Primitiva Gas and Electric Lighting Company. It will be remembered that this Company was registered in the early part of last year, with a capital of £1,200,000, to adopt an agreement between La Companhia Primitiva de Gas de Buenos Ayres and H. Ward, to acquire gas or electric light works in the River Plate and other countries in South America or elsewhere; and last week the first annual meeting was held. The new Company possess a strong Board, with Mr. H. E. Jones at the head; and a thoroughly capable Engineer has been chosen in the person of Mr. G. W. Anderson, formerly of the Caterham Gas Company. Everything points to the fact that the undertaking is being placed on a thoroughly businesslike footing; and modern labour-saving devices are being adopted, with a view to reducing the cost of manufacture. Mr. Jones, however, had to lament the fact that, in the case of his Company, as in that of the other two, the usual advance in the consumption of gas had not been experienced in the past year; but he pointed out that, though the existing commercial depression had no doubt something to do with this, another reason was to be found in the rapid introduction of incandescent gas lighting. The situation is therefore not without promise, for such an improvement in the duty obtained from the gas supplied cannot do otherwise than benefit the Company in the end, however much it may affect the consumption for a time. Then, again, the Company are in possession of an efficient electric lighting plant, in which a large proportion of the capital has been sunk; so that they are in a position to satisfactorily supply their customers with whichever form of illumination they may prefer. Thus, though the output of gas did not increase at all in the past year, the supply of electricity showed a very comfortable growth of 8 per cent. Though there was a balance in the accounts of over £12,000, or about sufficient to pay 3 per cent. on the ordinary shares, the Directors very wisely decided, in view of the unsatisfactory state of business in Buenos Ayres, and the fact of this being their first year of office, that it would be better to carry the amount forward. In this they are certainly wise; for though there is every reason to anticipate that Mr. Jones's expectation of being able to produce a more favourable balance-sheet next year will be realized, it would be a very mistaken policy to start the career of the new Company by the payment of a dividend which it might in the future be found impossible to maintain.

WATER AFFAIRS.

The Progress of Water Legislation.

THE Joint Committee of the two Houses of Parliament who are endeavouring, with the assistance of a strong array of learned Counsel, to make a good Bill of a measure which, on its introduction, was most contemptuously described as Mr. Long's "miscegenous bantling," resume their sittings to-day, and proceed to the consideration of clauses. Fourteen days have already been occupied over the Bill, and about one-third of the clauses have been dealt with. It should therefore be possible to make good headway with the remainder before the commencement of the Coronation festivities. Some important alterations have been effected so far, the precise nature of which will be better appreciated when a comparison is made between the amended print of the Bill promised by Mr. Fitzgerald and the one originally issued. The Local Government Board, the Companies, and the County Council have each scored points; but there is still the formidable obstacle of the third schedule to be overcome. Apart from the London Bill, water legislation generally made satisfactory progress in the second portion of the session. The Bill promoted by the Birmingham Corporation to obtain an extension of time for the completion of their Welsh water scheme only awaits the Royal Assent; and the unopposed Bill of the North Darley District Council, to sanction the construction of additional works, is in the same position. The scheme for the constitution of a Joint Water

Board for Higham Ferrers and Rushden will no doubt go safely through the Upper House as it has done the Lower one; and there does not appear to be any impediment to completion of the project for the amalgamation of the Weardale and Shildon and Consett undertakings. The Grand Junction and Kent Water Companies' Bills are safe; and the Limpsfield, North Warwickshire, and West Gloucestershire Companies will obtain authority over the extended areas for which they have applied. The Bill introduced by the Street Urban District Council to enable them to construct works and supply water, and that of the Wrexham Water Company, asking for more capital and authority to construct additional works, have reached the final stage. Points which have arisen during the progress of the various Bills have been dealt with in our "Parliamentary Intelli- "gence," and they do not call for further comment. As far as Water Bills are concerned, the last period of the session, which commenced yesterday, does not promise to be productive of anything of more than ordinary interest to our readers.

Bradford's New Water Supply.

THOUGH there was no public demonstration in Bradford on Saturday, the 17th inst., the day will be a memorable one from the fact that an event then occurred of the first importance to the inhabitants. On that day there was witnessed the completion of the first instalment of a scheme which will be capable of furnishing the city with an additional 25 million gallons of water daily. A dozen years ago, the future needs of Bradford were recognized; and the Corporation took the necessary steps to meet them by obtaining parliamentary powers to secure an extensive catchment area in the valley of the Nidd, and bring its waters to the city. With the able assistance of Mr. James Watson, the Water-Works Engineer, and the expenditure of about £1,500,000, they have had the great gratification of seeing the successful outcome of their labours, whereby a population of 450,000 are relieved of the immediate possibility of a water famine. Those who have suffered from such a calamity—for example, their neighbours at Huddersfield—will appreciate this relief at its full value, and will in all probability consider that it has not been bought any too dearly. Already Bradford has felt the pinch; and when, last September, the contents of the reservoirs had been drawn down very low, necessity compelled resort to the waters of the Nidd before they could legally be taken. But when the welcome rain came and replenished the stores, operations were resumed, and the works were finished—so far, that is to say, as the portion in question is concerned. There still remains to be carried out the second instalment, comprising the construction of a reservoir at a point higher up the river than the present intake, which will entail the outlay of another £500,000 or £750,000. But even if the cost should exceed the higher of these amounts, we are sure it will be willingly incurred, in view of the importance to the health of the population and the staple industry of the city of a constant and ample supply of such water as that which the new scheme will furnish. We cordially join in the congratulations which have been offered by the Water Committee and the townspeople to Mr. Watson on his success, and trust it may attend him in the execution of the section of his scheme shortly to be undertaken.

Southern District Association.—The arrangements have been completed for the usual spring "outing" of the members of the Southern Association. It is fixed for next Thursday week (June 5). Assembling at Richmond Station, the party will at once drive through Richmond Park to the Hampton Gas-Works, which are under the Management of the President (Mr. W. E. Price). The visitors will be entertained at lunch by the Directors. Afterwards, the works of the Southwark and Vauxhall and Grand Junction Water Companies will be inspected. A visit to Hampton Court Palace will follow; and by this time the members will be well prepared for tea, which will be served at the Mitre Hotel.

High-Pressure Gas Lighting in Berlin.—Since the end of March, the greater part of the Alexanderplatz in Berlin has been lighted by the "Millennium" high-pressure gas-light. There are twenty lamps, fifteen of which are fitted with two burners apiece. Each of these burners has an illuminating power of about 660 candles. The 35 burners light the Alexanderplatz with the brightness of daylight. The great number of electric arc lamps in the neighbouring shops are (according to the "Journal für Gasbeleuchtung") far surpassed by the flood of light from the "Millennium" lamps. The extension of the system to the whole of the Alexanderplatz, and to the adjacent streets, is now being contemplated.

ESSAYS AND REVIEWS.

THE INEFFICIENCY OF THE WAGES SYSTEM.

THE series of articles that not long since appeared in "The Times" under the title of "The Crisis in British Industry," and the voluminous correspondence thereby evoked, have served, among others, one very useful purpose—that is, to draw attention afresh to the failure of the wages system, pure and simple, to obtain the best results for either the wage-earners or the wage-payers. Whether or not we are face to face with a crisis in the industrial history of this country, we are not now concerned to discuss; only pausing to observe that the next few years will probably witness a growth in the keenness of the struggle with our trade competitors that will try the soundness of our industrial system in its uttermost parts, especially in regard to the efficiency and productiveness of labour. What we wish chiefly to deal with at present is the particular question of the efficiency, or rather of the inefficiency, of the wages system, and of the possibility of improving or superseding it.

This is, of course, no new question. It is as old as "the oldest inhabitant," but has grown in difficulty, and therefore in importance, with the growth of the factory system, and is rendered yearly more pressing through the steady supersession of the individual employer by the joint-stock company and by combinations of joint-stock companies. The man is getting further and further removed from contact with his ultimate master; the sense of personal relationship is becoming almost completely destroyed, and is, unfortunately, only too often replaced by a sense of mutual antagonism. A working man, writing to "The Times" recently, put it, as a natural and rightful relationship between labour and capital, that the master tries to get the most he can out of the man for the least money, and the man tries to get as much money as he can out of the master, and to do in return as little as he may without "getting the sack." And this is, without doubt, the view taken of the question by a vast number of workmen, and by an all too large number of employers. While, therefore, it is fundamentally true that the interests of capital and labour are bound up together, and that the best results can only be obtained for both by their working in harmony, it is also undoubtedly true that very few workers realize this fact; that the majority act as though the opposite were the truth; that many employers do not take any steps to enlighten the men; and that the wages system, coupled with the influences of Trade Unionism, encourages the growth of the belief that capital is the enemy of labour.

These are the facts that have to be faced; and no amount of mere denunciation of labour leaders for teaching fallacious and injurious doctrines of political economy, or of the men for listening to, and putting into effect, those doctrines, will do anything material to mend matters. The wise physician is he who does not treat the patient merely for the symptoms of the disease, but finds out and eradicates the source of the evil. He does not give ointment for a sore when it is defective digestion that has polluted the blood. And the source of the unhealthy relations between labour and capital at the present time is to be looked for below the symptoms arising therefrom. It lies in the failure of the wages system to create or strengthen any bond of mutual interest and understanding between master and man.

The root-evil of the wages system is that, while labour plays the most obvious part in the work of production, the share of the product that it receives is, speaking broadly, unaffected by the amount of profit obtained by the sale of that product. There is, therefore, no direct incentive to labour to produce as cheaply and as satisfactorily as possible; with the result that, except for the comparatively few men who are so morally constituted that they always do their very best, regardless of fee or reward, a determination prevails among the labouring classes to do as little as they can for the wages they receive. This determination is greatly strengthened by the widespread idea, carefully fostered and energetically taught by the Trade Unions, that the less work each man does the more men will be employed. Now this idea, fallacious though it undoubtedly is, cannot be dissipated either by denunciation of the "go-easies" or by the mere assertion that it *is* fallacious; for it can be supported by very plausible arguments, which doubtless appear to be irrefutable to the ignorant. Indeed, in a limited measure, the idea is founded upon truth—that is to say, it is very often necessary to look beyond the immediate future to perceive the inherent fallacy and the ultimate harmfulness of the policy.

To illustrate the point, let us suppose that a contract has been given out for the building of a factory, involving the employment of twenty builders' labourers provided each man does a fair day's work. If these twenty men resolve, in common with all other builders' labourers, to work so "easily" as to do only 80 units of work in the time in which they could and should do 100, either another five men must be employed or the job will take 20 per cent. longer to do than it otherwise would. Anyhow, the labour cost will be increased by 20 per cent. The men can follow the argument so far; and it appears to them incontestably true that, by thus failing to do a fair amount of work for their wages, they are giving employment to men who would otherwise be out of work. What the great majority of them fail to see, and what no one of the leaders points out because they themselves mostly

cannot see it, is that, if the cost of building factories is enhanced by 20 per cent., or whatever the increase may be, the likelihood of there being factories to build is greatly diminished, owing to the cost of production in the factories being increased to such a figure that the manufacturers are unable to compete with their foreign rivals. So that, eventually, not only is there not so much employment for builders' labourers as there would be if building were less costly, but there is less demand for labour in the manufacturing industries, labour is more of a drug, and wages are generally reduced.

The difficulty is, however, to get the truth in this matter into the minds of the men. Abuse will not do it; for, while the result of the adoption of a "go-easy" policy by the men is to lower the morality and destroy all sense of honour in the great majority of them, it must not be forgotten that this policy originated in the altruistic, if impracticable, doctrines of philosophic Socialism—being adopted by the employed partly with the object of giving work to the unemployed, as well as with a view to making jobs furnish longer employment to those engaged on them. It is, therefore, necessary to try to prove to the workmen in this country, not that the policy is a dishonest one, but that it fails of its object, and actually injures those whom it is intended to benefit. And this will never be done so long as men and masters stand aloof, with the Trade Unions in between.

There is, moreover, apart from the stumbling-block of Unionism, this great difficulty in the way of bringing about a better understanding between the two parties—that the employers, while conscious that everything is not well in their relations with their men, do not, many of them, go to the very bottom of things, think out remedies, and undertake the arduous task of applying them. They mutter, and grumble, and occasionally curse, but fail to realize that if improvement is to come, they must be the initiators. It is, therefore, most essential that they should be made to realize: (1) that the system is radically a failure, (2) that it can easily be amended, and (3) that the amendment must be initiated by them. Every attempt to draw attention to the inherent defects of the wages system, and to point to a solution of the difficulty, is, consequently, most welcome; and we are delighted to find so lucid a writer as Mr. Ralph Neville, K.C., entering the arena against the existing method. In the "Monthly Review" for February there was published a very able article from his pen, entitled "British Industry and the Wages System;" and we hope that his contentions and conclusions may be studied by a wider circle of readers than technical journals can expect to reach.

Mr. Neville first points out the incontestable fact that Trade Unionism does not make for efficiency of labour in any industry. He says:—

> To be effective, the association of labour must be wide; and, to attract the largest numbers to their ranks, Trade Unions must aim to secure the highest possible wage to the largest possible number of men. But if their nets are spread wide, they will enclose men of every degree of capacity, while the natural interests of the most capable differ widely from those of the least capable. If, therefore, solidarity is to be maintained, Unionism must be based upon conventions which will indentify so far as possible the interests of all. In dealing with the remuneration of labour, therefore, Unions will favour equality as a means of assimilating the interests of all their members.
>
> Now equality in wage necessarily tends to equality in the return given for the wage. If, for instance, two men are working side by side, and one is capable of turning out twice the work of the other, he will not be likely to do so, or to continue for long to do so, if the remuneration of both remains the same. Before long, some sort of standard of a day's work will be arrived at. But inasmuch as the day's work must not, in the interests of the Union, be beyond the capacity of any of its members to perform, the standard cannot be fixed with reference to the capacity of the most efficient, nor, indeed, with reference to the capacity of the average man; it must be based upon the capacity of the least efficient. The tendency of Unionism, therefore, is to reduce the labour of all to the standard of the least efficient.

The natural result is that the men lose interest, and take no pride in their work; and the cost of production increases, while the quality of the product decreases. Trade Unionism, by the effects produced by its operations among workers paid on the ordinary wages system, stands condemned. But Mr. Neville takes the view that, for good or evil, Trade Unions are among us, and will remain; as, although the employers could destroy them had they the determination to do so, the cost of the destruction would be too great, and might bring Nemesis, in the shape of combination among the working classes to capture and turn against the employers the legislative machinery. The problem, therefore, is to counteract the influences of Trade Unionism—to give the men some system that will bring them all the benefits of Unionism and more—to interest the men in their work, to raise the level of efficiency, to encourage the capable, and so to bring increased prosperity both to employer and employed.

To do this, the generally prevailing wages system must be reformed; and Mr. Neville performs a very considerable service in pointing out to the public, what students of the subject know full well, but what does not strike the average man—namely, that the wages system is not a palladium of the industrial citadel. "That system is, it is true, of wide extension; but," it is pointed out, "it is a mistake to include it in the category of the divine institution sent direct from heaven for the benefit of the upper classes. On the contrary, it is a thing of mushroom growth, the evil effects of which we are the first to feel, because we are in a later stage of industrial development than our neighbours. It is remarkable," continues Mr. Neville, "that, while the proposals of Socialists are very properly condemned, on the ground that they offer no adequate incentive to exertion, and while it is recognized that under a Socialist *régime* the whole nation would be likely to 'ca'canny' and 'go easy' into the abyss, the absence of any such incentive under the wages system, affecting as it does the majority of the people, should pass unchallenged, and apparently unnoticed. The very symptoms foreseen to be the inevitable result of the one system make their appearance under the other, yet they are attributed to original sin, false teaching—anything but the same cause."

It is, then, for the employers to provide the necessary incentive to exertion—not merely to sit still, wring their hands, rail against the men and their leaders, and wait for a miraculous conversion of the misguided. This is a point that cannot be too often emphasized—the initiation of reform must come from the employers. Jevons pointed that out forty years ago; and he pointed also to the solution of the problem. But we are a slow-moving people—patient as the ass, and often as stupid.

Mr. Neville refers to one plan for providing the necessary incentive to exertion—namely, the premium system—by which work above a certain standard of quantity or quality earns a special rate of pay; but he points out the one serious defect in this system. "It has not the merit of reconciling the interests of capital and labour. The rate of the minimum wage and the amount of the premium are left of the first importance, and are as likely to provoke conflict as ever. The strike against the Steel Trust shows how readily such a conflict may arise."

Mr. Neville's remedy is no novel one to our readers. It is profit-sharing combined with co-partnership. And that is our own. It holds the field, and is slowly making headway against the conservatism of the employer and the suspicion and ignorance of the employed. There is no need for us now to discuss systems, or details of systems, of profit-sharing. Our purpose has been rather to emphasize as strongly as possible the inefficiency, the serious inefficiency, of the generally adopted wages system, and if possible to persuade employers of the absolute necessity of their taking the question up, and themselves tackling the difficulty before it overwhelms them.

> When labour has learnt that high wages, short hours, and go-easy, is an idle dream, when capital has learned that a monopoly of profit may end in the destruction of the profit itself, they will become more receptive to new ideas. The question of pressing importance is whether either or both of these lessons will be learned in time to save the trade upon which our prosperity depends. The answer to this question turns upon the intellectual attitude of the nation as a whole.

The last sentence in the foregoing paragraph strikes to our ear a pessimistic but true note; for the intellectual attitude of the nation as a whole is not at the present moment altogether one to excite unqualified admiration. Earnestness, thoroughness, and the power of concentration are not its most striking characteristics. But the touch of adversity would doubtless bring those qualities again to the surface; and we have thus no fear as to the ultimate ability of our countrymen to hold their own in the coming struggle for industrial existence.

ON A PHASE OF THE DISAGREEMENT BETWEEN GAS ENGINEERS AND ELECTRICIANS.

THERE are several ways of carrying on a controversy; but only two or three of ending it. There are some controversies—and these not the least interesting and important in their way—which are never ended, but perpetually break out between fresh disputants. Of these, is the disagreement between electricians and gas engineers in regard to the relative cost of gas and electric lighting. The question here is not of the comparative attractions, advantages, or desirability of these illuminants. These are largely questions of taste, as to which disputation is proverbially vain. Gas engineers have long since tacitly accepted the rivalry of electric light as a condition of the existence of their industry in modern times; and most of them perceive that this is all for the best. It is quite useless to tell a man who avows a predilection for a particular thing in a shop window that he had better prefer something else; and gas engineers are not, as a rule, so foolish as to irritate possible customers by dictating to them. But on the point of cost, gas engineers are legitimately stiff. They will not allow to their trade rivals the right of misrepresenting this consideration which they are continually exercising. Moreover, gas engineers protest, with justice, against the style in which electricians attempt, time and again, to carry their point in this respect by bare, unfounded assertion.

The leading electrical journals are as bad as anybody in trying to carry this point by mere bouncing *ipse dixit*. They must be told emphatically that this kind of treatment is not good enough. Readers of the "JOURNAL" will remember how, on April 11, the "Electrician" challenged editorially the Crystal Palace District Gas Company, "or any gas authority," to prove the statement, contained in a circular issued by the Company in the ordinary way of business, that the cost of gas, at 2s. 7d. per 1000 cubic feet, burnt in incandescent burners, is less than one-tenth of the cost of electricity when sold at 6d. per unit, light for light. We took up the challenge, and gave the simple facts upon which anybody can make the comparison. Our contemporary made a very lame reply to this exposure, involving a reference to the possible

performances of the Nernst lamp; but it has ignored everything we have since advanced on this aspect of the matter, cited from its own columns.

Now, again, the other leading journal of the electric lighting interest in this country, the "Electrical Review," has indulged in a similar exercise of mere assertion. This time it is matter contained in the Presidential Address of Mr. Holgate to the Institution of Gas Engineers which has excited the electrical storm. Our contemporary, like its fellow periodical before it, has been left "breathless" by certain "outrageous statements," which it attributes to Mr. Holgate on the authority of an abstract report of his address which it credits to the "Mechanical Engineer." These observations run as follows: "He said while gas could furnish all the essentials with economy, electricity could only offer the advantages of portability and beauty of appliance, but purchased, of necessity, at a cost that was extravagent. Power from electrical motors was four times the cost of power from a gas-engine; and the consumer who wished to have the electric light, could produce it on his own premises by means of a gas-engine at a cheaper rate than he could buy it from the electric supply companies. The most successful application of electricity was that to tramcar propulsion, not because it was cheaper, but because of the smoothness of running." Hereupon the "Electrical Review" summons back enough breath to remark, "We have no hesitation in absolutely contradicting any one of these statements—the last especially—and it is impossible for the speaker to prove them." Well! what of it?

Does it occur to any reader of this contradiction that it is sufficient to crush Mr. Holgate, and wipe out his carefully-reasoned statement? Why is not his word as good as that of the Editor of the "Electrical Review?" The editorial particle is not so valid as all that. Meanwhile, it would have been wiser on the part of Mr. Holgate's gainsayer to have gone to some verbatim report of his address, and noted what he actually did say. Not that the text would have had a less overwhelming effect upon the critic; but the abstract cited does not happen to be well made. What Mr. Holgate said, in regard to the first part of the report, was that "in supplying *heat*, we can furnish with economy all the essentials," &c. Surely, electricians do not plume themselves upon their heating appliances? And in regard to the last passage of the abstract, which is especially contradicted, reference to the text shows that Mr. Holgate said that electrical tramcar propulsion "is not proved to be more economical than gas traction." This illustrates the rashness of accepting second-hand reports of any public statements which are considered to be worth criticizing at all.

It is scarcely necessary to remind our readers that Mr. Holgate's address contained a good deal more than the above comparatively mild statements to horrify electricians. We are not concerned to pick these out, or to defend them before they are attacked. Mr. Holgate is competent to defend his own statements, if necessary. What we are now particularly desirous of making clear beyond the possibility of misunderstanding is that the gas industry will not silently endure this pretentious contradiction on matters of fact at the hands of those who are no other than trade rivals. Who are the electrical journalists that they should chalk up contradictions of other men and then run away? There is a story of a Scotch dominie, who, in the course of his sermon, said, "Bellarmine says yes. I say no. And now, having confuted Bellarmine, we will proceed." This pragmatical parson must have had pupils who went into the electric lighting business, and took to the journalistic branch.

It argued a considerable degree of courage in Mr. Holgate to speak a good word for that very hardly done-by invention, the gas-driven tramcar. He is to be commended, certainly not abused for it. Besides, there is more to be learnt from a passionless review of his statement on this head, paying him the ordinary compliment of assuming that he was speaking the truth as he knew it—which even a gas engineer may fairly claim—than there can be from an intemperate imputation of mendacity. As a matter of fact, Mr. Holgate spoke strictly according to book; and he said no more for the gas-power tramcar than such competent judges of evidence as Mr. Fletcher Moulton and Mr. Roger Wallace believed. Yet, as is admitted, this kind of mechanical tramcar propulsion has not made headway against electric traction. Why? Mr. Holgate's reason—that the latter gives the smoother rnnning—is as good as any. It is well worth knowing that the advantage of cheapness is not everything in business.

We do not dispute, or cavil at, the vogue for electric tramways. Let it stand upon the merits, which are ample, if not conclusive. Yet the last word on this head is not exclusively with the electricians. A recent issue of the leading French engineering journal, "Le Génie Civil," contains an account of a compressed air power station established at Billancourt for the service of the Paris General Omnibus Company. The plant is quite on a par, for importance, with the usual electric power generating stations of tramway working, having a total capacity of 7000 indicated horse power. It compresses air up to 1140 lbs. per square inch, for delivery through mains to the different charging points, and the accumulator house. The recommendations of compressed air for driving tramcars are not such as electricians dare despise. It is at least as cheap as electricity, and is in many respects more manageable, especially in the matter of storage. And what is true of compressed air, is largely true of gas. Let it be understood that for the time being gas-power traction of tramways is under a cloud. We should not like to prophesy that this will always be the case. It is not a little remarkable, in connection with this reflection, that, with few exceptions, all the automobiles in use at the present moment are dependent for their motive power upon gas-engines. True, the fuel is petroleum spirit, mixed (in the case of France) with alcohol of native production; but the whole business is as yet in a stage of forced development. For some inscrutable reason, the most influential patrons of motor-cars have just now gone demented on road racing, which must prove a temporary hallucination. Nobody really wants to tear about the country at the rate of forty miles an hour, or should be encouraged to do so.

When the trade in motors settles down upon a rational basis, carriages capable of negotiating any ordinary road at about the top speed of an electric tramcar will be the chief market. If, as appears likely, the motive power in these cases continues to be gas, there will be an irresistible revival of interest in the gas-power tramcar. It is not every tramway in the country that can fill cars all day, at such frequent intervals that there are always three cars in sight at once, on any part of the route; and unless this is the case, there is not much money in electric tramway working. The self-contained car is likely to gain in popularity, rather than lose ground, after the public have become thoroughly familiarized with the merits and the short-comings of electric traction, in which eventuality Mr. Holgate's pious wish that gas may have a larger share in serving tramways, "doing this with undoubted advantages both to the appearance of our roadways and the pockets of the ratepayers," may not be such a wild aspiration after the unlikely as his electrician critics pretend.

Taking all these considerations together, therefore, we have to represent to writers and speakers in the interest of electricity, that they had better step down from the pedestal of the *ipse dixit* when they find themselves confronted with gas engineering statements which they would rather that our common patron, the British public, did not believe. They must learn the somewhat humiliating lesson that their advertisements are no more convincing than those of any other dealer in marketable commodities; and it would be to their advantage not to become breathless, or indulge in any other ladylike emotion of resentment, when a gentleman hailing from the neighbourhood of the Crystal Palace, or from Halifax, talks "shop" in a style they do not like. Let him be confuted, if possible, and so covered with shame for a cozening rogue; but he is not to be overwhelmed by a haughty stare from the doorstep of the emporium over the way.

PUBLIC LIGHTING THE CONCERN OF THE GAS COMPANY.

THERE seems to be a disposition on the part of some gas companies to heedlessly let the lighting of the streets slip out of their hands into those of the electrical competitor. We have heard of cases where a little enterprise on the part of gas companies in showing local authorities and the people the best side of gas lighting might have saved street lighting for gas, and moreover might have prevented the sinking of a considerable sum of the public money in a doubtful venture. Again—not so much perhaps latterly as a few years since—it was not an uncommon thing at meetings of gas companies to hear that a certain amount of the street lighting had gone over to the adversary, but that it did not matter much as the public lighting was not the best paying part of the business, and the plant that was used for the production of gas for this purpose could be better utilized in meeting the increase of business in other directions. From our way of thinking, the company who have not the spirit of adventure within them in this matter, and the company who do not care for the loss of the public lighting are both mistaken—the first deserve to get ousted from the streets, and the second are labouring under a misconception as to the importance of retaining the street lighting.

In trying to keep a hold on business in any direction, the primary essential is to have a strong belief in the superior merits of one's own commodity. It is hardly within the region of belief that there exist to-day a gas directorate or gas officials who are not convinced that they possess the best means of producing at once the whole range of a light's virtues—cheapness, brilliance, convenience, and exuberance of diffusion. The first and third merits are easily proved from the pages of the "JOURNAL;" the second and fourth need only for confirmation an ocular demonstration such as is afforded at the Wolverhampton Exhibition at the present time. Let anyone who is unconvinced brave the heights of the water-chute there on a dark night, and look down on the lights below; and if he does not come away convinced as to the superiority of the incandescent gas-lights over the electric arc lights, then there must be something lamentably wrong with his vision. There, on the one hand, are the sharply defined globular electric arc lights, merely appearing as balls of light in the darkness; on the other hand, there are the Welsbach self-intensifying incandescent gas-lamps throwing a flood of pure, and in contrast, golden light over the walks and the buildings. On the one hand again, the only signs of life that can be seen under the electric arc lamps are black moving objects; while under the incandescent gas-lights men and women, features and colours, are as distinct from aloft as in sunlight. A comparison such as this in every town in the country is, of course, out of the question; but a demonstration by enterprising gas companies as to the effulgence given by a number of high-power gas-lights is perfectly feasible. A single lamp such

as we frequently see outside the door of a gas company's office is not sufficient. A whole street should be lighted to give a continuous run of brilliance, in order to make an impressive demonstration and to start people on something to talk about; and depend upon it the expenditure of the one or two hundred pounds in this way will be an investment which will never be regretted. The return if not a direct one, or if not immediately or expressly traceable, will be sure to come one way or the other.

This brings us to the point as to our belief that it is a fallacious policy that allows the street lighting to slip away simply because it is the poorest paying part of the business. This is a day of competition among lighting agents; and where there is competition, there must there be advertisement also. Every gas-lamp post should stand a striking advertisement for the gas company. We do not hesitate to go to a greater length and say, that better far would it be not to make a penny profit on the street-lamps, if income and expenditure can be made to meet, if, by so doing, the public lighting can be retained for its advertising power among private consumers and the owners of business establishments, and the competition of the electric light thus be kept at bay. As was recently remarked in these columns, it is frequently for the purpose of street lighting that electricity is first adopted, and it is often the street lighting that forms, or is made to form, the backbone of a local authority's electric-lighting business. Once the local authority starts street lighting by electricity, then every public electric lamp put up is an advertisement for electricity, and an invitation to private consumers and others to change their custom. With a prepossession in favour of electricity, local proof must be given to the public authorities that their fancy is wrong, and that the greater merit is to be found in the old shop. The extent of the change of opinion depends largely upon the degree of the gas company's enterprise.

In commercial competition, an honourable finesse is legitimate; and gas companies should, by all fair means, keep their hold upon the street lighting. One way to do this is to put themselves voluntarily forward to work with the local authority for the betterment of street lighting, and not wait for something to turn up, in the shape of a request from the governing powers or a suggestion of electric light, to put them into motion and on their mettle. It has been rather amusing to watch the flurried activity of certain gas companies, in possessing themselves of a large high-power incandescent gas-lamp and setting it up in a prominent position directly the terrible word electricity is breathed in the local Council Chamber. What is the result of such a pathetic exhibition of haste? Very naturally the question is passed round, why was not this done before? and very naturally again the people argue that there is nothing like a little fright and competition to make such gas companies as these take a greater interest in their own business, and look after the people they serve. All this merely brings ridicule upon those companies; and the responsible gas official must sometimes, under such circumstances, feel that he would rather go round by the bye-ways than pass the light his company have set up as a signal of their distress. It is only to the gas companies who have made no effort that this article is particularly addressed; and to them we once more say that better by far is it to early offer to do something for the improvement of the lighting of the streets than to court, by unconcern and indolence, the bringing of a competitor into the district.

The question may then be asked, what are the best steps to be taken in this matter? The answer must necessarily be a very general one, as the needs and circumstances of districts vary so considerably, and the gas official should be in a better position to judge of them than anyone else. But a hint or two may be given from what has actually been done by certain companies; and what they have done may, we admit, have several precedents. We should place in the foreground a good demonstration in lighting, and on the top of that a good effort to unite with the local authority in making an all-round improvement. The Croydon Gas Company recently showed one way of doing this when they voluntarily knocked off the 4s. 6d. per lamp which they had been charging the Corporation for incandescent gas-lights over and above the charge for flat-flame burners. This on the 1500 and odd gas-lamps in the borough (when all are converted) will represent an annual saving to the Corporation of nearly £350. But the Crystal Palace District Gas Company have also between 400 and 500 lamps in the district of the same Corporation. They have gone "one better" than the Croydon Gas Company; and their proposal appears to us to be very suggestive for other gas companies. The offer they made to the Croydon Council (and which has been thankfully accepted by the latter) is on the following lines: At the present time about half the lamps supplied by the Crystal Palace Gas Company in the borough of Croydon are fitted with incandescent burners and the remainder with flat-flame burners. The Company suggested that the flat-flame burners should be removed, and replaced with the latest and best pattern of incandescent gas-burners, made specially for street-lamps by Messrs. William Sugg and Co. These burners have recently been installed by the Company in Beckenham and Camberwell. The cost of the burners, including the work involved in making the change, will be 10s. each; and the Company are going to provide the burners and take payment for them out of savings effected by the arrangement, as will be seen presently. In this way, the burners will be paid for during the first six months, and will then become the property of the Corporation. During this period all the lamps are to be charged for at the present rate for flat-flame burners, and afterwards at a reduced rate. The present charges for lamps lighted in the borough by the Crystal Palace Gas Company are: Ordinary flat-flame lamps £3 7s. 6d., less 5 per cent., per lamp per annum; and incandescent lamps, £3 10s. 8d. net. The Company are now going to supply and maintain all the incandescent lamps, both those now in use and the proposed additional ones, at an inclusive charge of £3 0s. 6d. per lamp per annum, less 5 per cent. discount. This charge is to vary proportionately up or down with any alteration in the price of gas. There will, it will be observed, be, under this arrangement, a saving of 7s. per ordinary lamp and 13s. 2d. per incandescent lamp per annum, as compared with the present arrangement, or a total of £252 4s. 2d. per annum. Thus: 209 burners at 7s. equal £73 3s.; and 272 burners at 13s. 2d. equal £179 1s. 2d.—making together £252 4s. 2d. The total cost of the 209 new incandescent burners will be, at 10s. each, £104 10s., which is much less than the saving the Council will effect in six months.

The Council have accepted this really generous offer, and, as already said, have thanked the Company for it. If gas companies who have not yet endeavoured to conciliate the local authority and the public by helping to give them good and cheap lighting in the streets do not find in the action of the Crystal Palace Gas Company a little lesson for themselves, then they must indeed be blind. The figures are all plainly set out; and other gas companies can make calculations from them and apply them to their own conditions.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1432.)

When the Stock Exchange reopened on Tuesday after the Whitsuntide holiday, there was a very poor attendance, and business was decidedly slack; and although it quickened up a little as the week went on, yet it never attained even a moderate degree of activity. The general tendency was good, instigated by a most persistent conviction that the Boer conference would result in terms of peace being arranged. An element of caution, however, still asserted itself, and there was no rush to buy. Gilt-edged securities and South African undertakings were chiefly benefited; but prices in general throughout the list show advances almost without an exception. The Money Market promised great ease at first, but grew firmer, and remained steady to the close. Business in the Gas Market was extremely quiet all through the week, and on some days especially so. Movements in value were neither numerous nor considerable in degree; and they were so irregular as to give no indication of anything approaching a predominant tendency. In Gaslight issues, there was some moderate dealing in the ordinary at very level prices, never rising above 94½, and never falling below 93½, and the closing mark was 94. The secured issues were very lightly touched. Prices were only moderate; and the 3½ per cent. maximum fell a point. South Metropolitan was also moderately dealt in. After a little hesitation, the weakness it has lately exhibited showed itself again, and on Friday it was marked at 119, with a corresponding drop in the quotation. A single transaction (at middle figures, in the new stock) was all that was marked in Commercial. The Suburban and Provincial group continued in their now habitual quiet attitude; and the only incident in the London market was a little improvement in British. In the Local Exchanges, there was a slight shrinkage in Liverpool and in Newcastle. In the Continental Gas Companies, the chief feature was the continued flatness of Union, which was marked on Thursday as low as 140. There were a few dealings at middle prices in Imperial, and a smart burst of activity in European, which, however, led to no change. Some of the remoter undertakings were favourably affected; the debentures of Melbourne and of Cape Town having an advance. In the Water Companies, there was hardly any business, and change in quotation was confined to a small rise in East London. There is not any likelihood of much change until the course shaped by the Government Bill shows itself clearer.

The daily operations were: Upon the reopening on Tuesday, business in Gas was very quiet, and prices were not remarkable generally. Continental Union fell 2. Wednesday was just as slack; but there were more numerous changes. British rose ½, Melbourne 5 per cent. 1, and ditto 4½ per cent. 2; but South Metropolitan receded ½, and Union 1. Thursday was quiet, and prices were only moderate. South Metropolitan fell ½, Gaslight maximum 1, and Union 2. Friday was rather more lively; but quotations remained unchanged. In Water, East London rose 1. Saturday was quiet. Cape Town bonds gained 1.

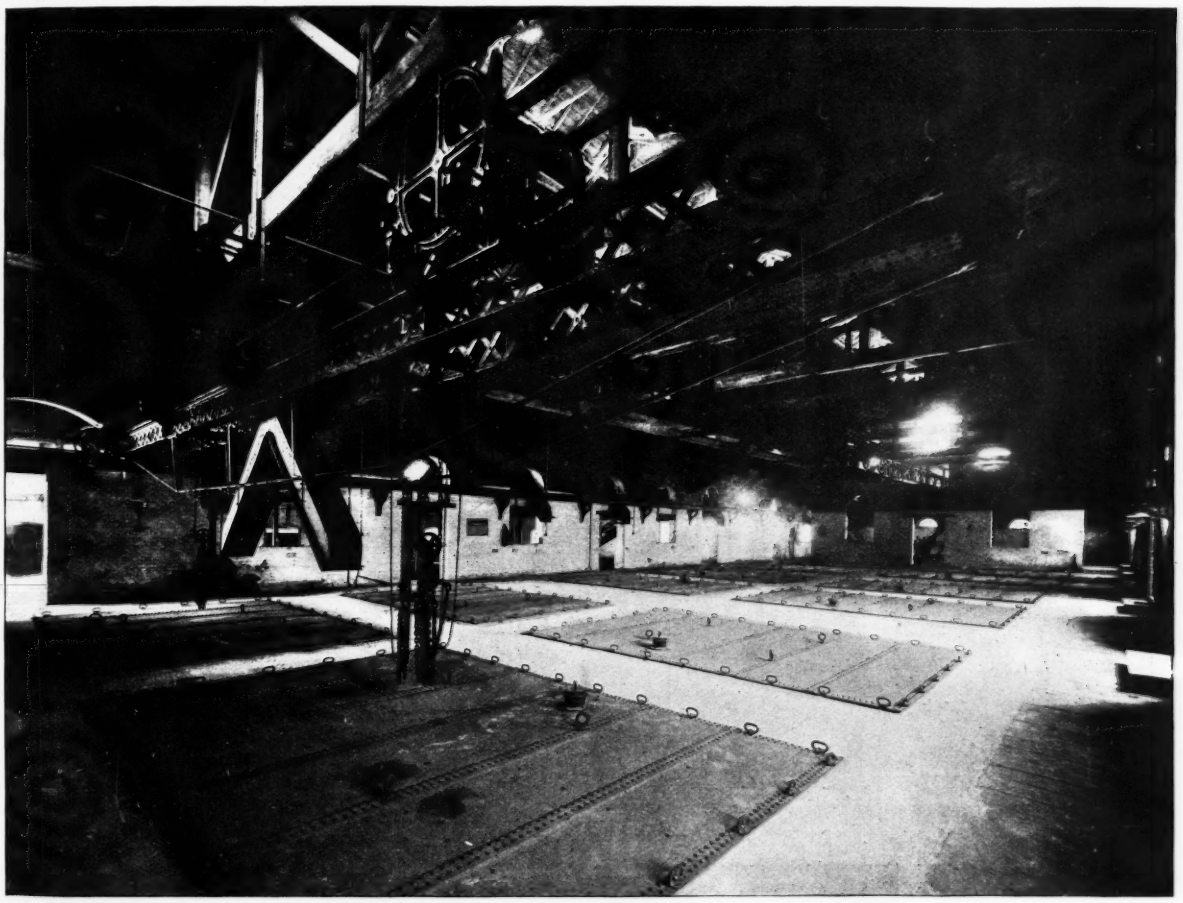
Masonic.—An intimation recently appeared in the "Journal" to the effect that Mrs. Sophie White, the widow of the late Gas Manager at Sherborne, was applying for a pension to the Royal Masonic Benevolent Institution. The ballot on the 16th inst., we regret to learn, only resulted in 376 votes being cast in Mrs. White's favour, whereas the number given to the first of the successful candidates was 7241, and the lowest received no less than 4157 votes. Further vigorous efforts are therefore necessary to secure Mrs. White's election in anything like reasonable time; and readers are urged to make a note of the case, and reserve all possible votes for the next ballot in November.

FROM OLD CONDITIONS TO NEW AT THE WALSALL GAS-WORKS.

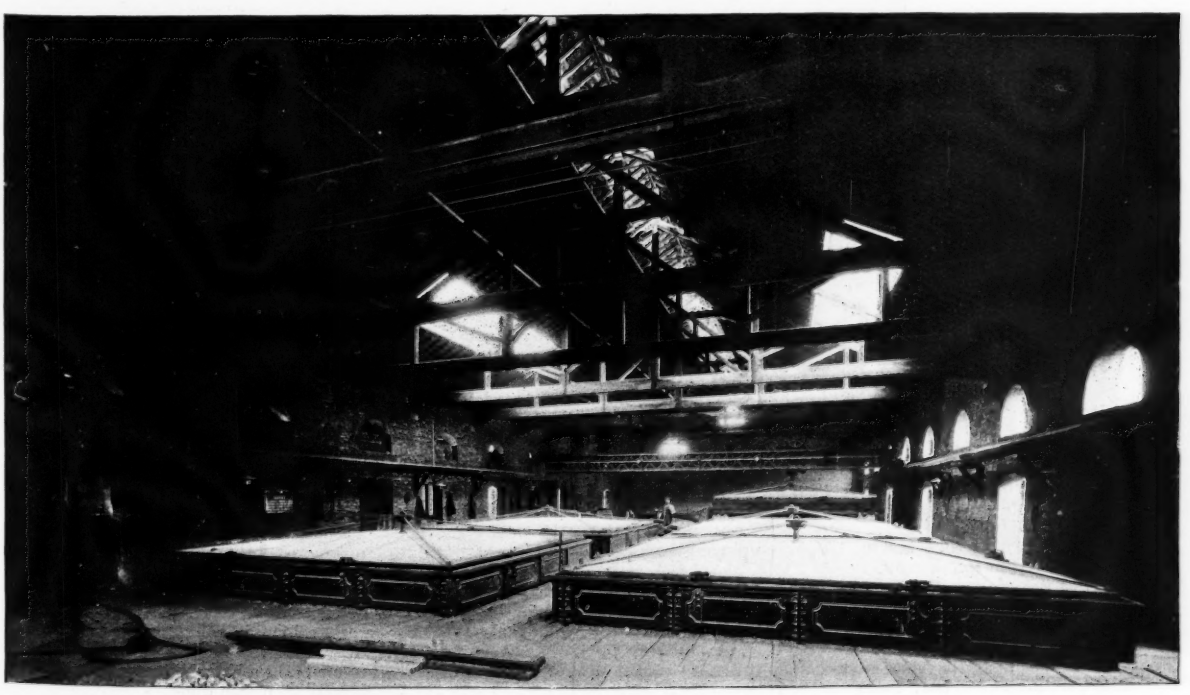
(*Continued from p.* 1348.)

New Purifying and Oxide Conveying and Distributing Plant.

If, in Mr. B. W. Smith's large scheme of improvement and addition at the Walsall Corporation Gas-Works, there is one part of the new plant which will have supreme interest for the engineering visitor, it is that which will be found in the purifying department. There a full hour or two can be spent with profit; and, on coming away from the inspection, one carries with him the idea that the Engineer has, by his arrangements there, obtained the maximum attainable work out of the circumscribed



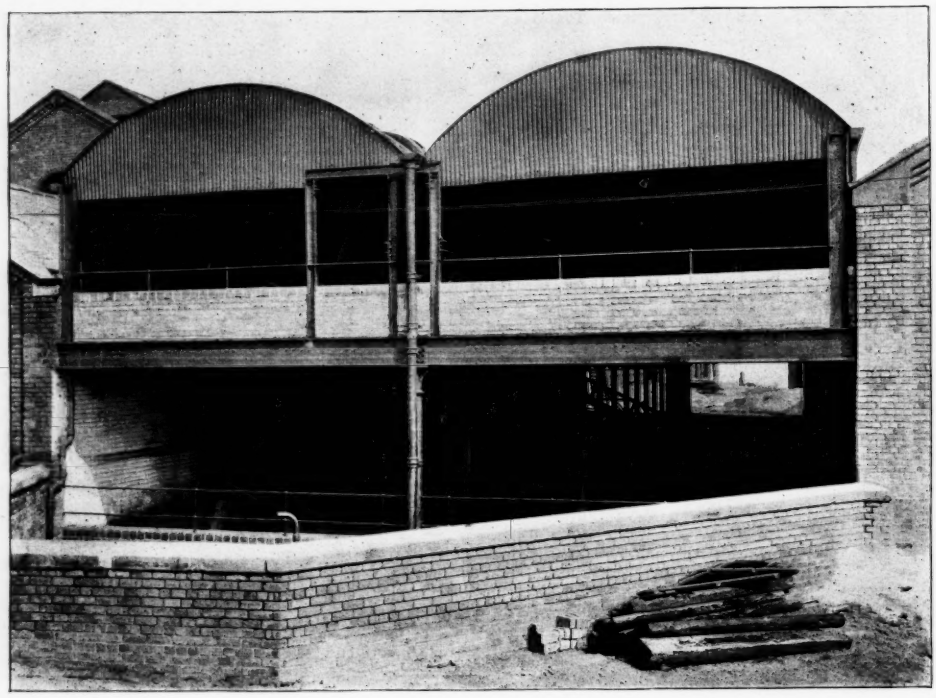
The New Purifiers, Showing in the Distance the Overhead Conveyor for Refilling the Boxes.



Old No. 2 Purifier-House—The Equipment of No. 1 was Similar to this Before the Alterations were Made.

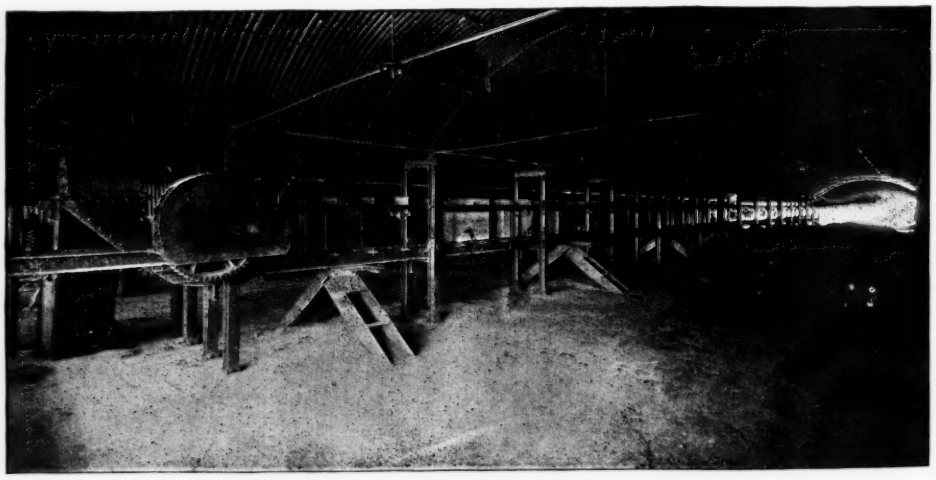
area and the conditions of the buildings which were at his disposal. Besides the freedom denied him in the preparation of his plans, on account of the limitation of space, here, as in the other parts of the works, there were certain considerations which had a compulsory influence in Mr. Smith's final determinations. There were the questions of capital economy, the time at command in which to effect the changes, the necessity of obtaining the fullest efficiency possible upon the same site owing to its already fully occupied environment, and the time-saving in the ultimate operations of discharging and re-charging the vessels.

There are two purifying-houses—known as No. 1 and No. 2; and each formerly contained six boxes, 20 feet square. The two houses combined were only capable of effectively dealing (giving them their extreme due) with 2 million cubic feet of gas per day.



End View of Revivifying-Shed, showing Spent Material and Return Elevators.

Under the then circumstances—the output having exceeded this, and the consumption being on the increase—this was altogether inadequate. In addition, the situation presented another difficulty, and one which, unavoidably without change, added to the labour expenditure upon the work of purification—that was, the scattered space available for revivification. There was the ground between the parallel side walls of the two houses, a small piece in front of the engine-house, the vacant floor area at either end of the purifying-houses, and a small building abutting on the rear end of No. 1 house, and constructed in line with it. This was insufficient for the purpose — especially having in view the greater quantity of material which would have to be dealt with in the future. The labour expense, too, considering the difficulties of dealing with the increased amount of material, would have been raised excessively, bearing in mind also that the wages of the class of labour employed had been recently advanced in the district.



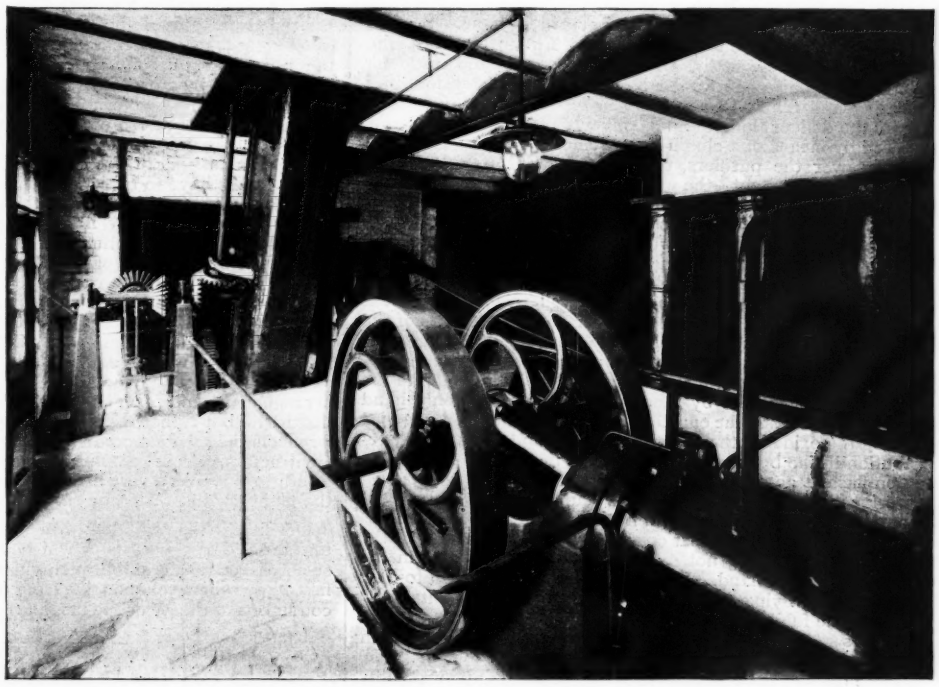
Top Revivifying-Floor and Longitudinal Conveyor, Showing Head of Elevator, &c.

It will aid the reader if, before giving the full particulars, we outline the general scheme adopted. Mr. Smith decided that the best and cheapest method of securing the necessary space for the accommodation of the new purifiers would be to pull out the six 20 feet square boxes in No. 1 house, and utilize, in addition, the small building at the rear end (already referred to as having formerly been devoted to the process of revivifying). The old purifiers had done a fair life's work, having been in use about a quarter of a century. They were worked by means of dry-faced centre-valves, and were supported on a mass of brick arches built up from about 13 feet below the floor-level. However, their dismissal from service, and bringing into the area thus opened up the small building at the rear end of the house, gave a disposable ground surface of 164 ft. 6 in. by 56 ft. 3 in. The task which Mr. Smith set himself to accomplish was to so utilize this area that it would be capable of dealing with two-and-a-quarter times the amount of gas formerly purified on the same area. Owing to the peculiar circumstances of the site, and the building being of limited height, the idea of a stage-floor could not be entertained without considerable alterations at great cost; and this Mr. Smith did not feel himself justified in recommending or incurring. He therefore determined that Green's system of dry-luted purifiers were best adapted for obtaining the maximum amount of purification out of the available space, and that, by placing the tops of the purifiers just below the level of the ground, he would leave a cellar under the boxes about 6 ft. 3 in. deep. Then, in regard to the revivification of the oxide, Mr. Smith resolved to construct upon the ground between the side walls of Nos. 1 and 2 houses a stage-floor revivifying-house — equipped, in conjunction with No. 1 house, with elevating, conveying, and distributing machinery both for emptying the boxes and returning the material to them after revivification. In his specifications and drawings, Mr. Smith embodied the whole of his requirements and ideas; and upon these the contractors tendered, and submitted their own detailed designs for the particular class of conveying machinery they proposed to supply. It was on Feb. 21, 1901, that the Corporation, on the Engineer's recommendation, entrusted the whole of the work—excepting the structural alterations and the building of the foundations (which were to be done throughout by Corporation workmen)—to Messrs. R. Dempster and Sons, of Elland. By the 1st of April, the old purifiers were put out of action; and the Corporation and Contractors' men started on the work of demolition and re-construction. Looking at the completed work, and running now over the plans before us as this is being written, one can fully appreciate the concentration of idea and scheming which the work involved on the part of the Engineer, and the admirable manner in which Messrs. Dempster gave effect, in a brief space of time, to the project. The work has indeed been well done.

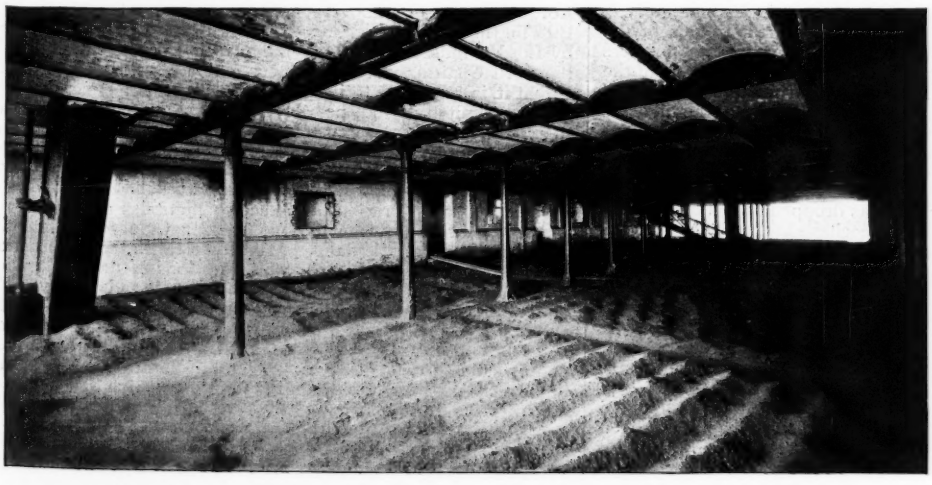
Turning, now, from these preliminary matters to a description of the new work. The purifiers in No. 1 house are eight in number,

each being 48 feet long by 18 feet broad, and 6 feet deep, constructed in pairs, on (as previously said) Green's dry-luted system. Each purifier has two openings in the top, 18 ft. 6 in. long by 12 feet wide—leaving centre gangways transversely 6 feet wide, end gangways 3 feet wide, centre gangways longitudinally 5 feet wide, and two outside gangways 3 feet wide. The space between the purifiers and side and end walls is floored over level with the top of the purifiers. While inspecting the new arrangements, we were interested in ascertaining the amount of space unoccupied by purification area in the 164 ft. 6 in. length of the house and its 56 ft. 3 in. width; and, adding together all the strips between the eight purifiers and the side and end walls, including the ends formed by the partition between the old purifying-house and the small building at the rear, all we could find was a total vacancy of 15 feet wide. So that the place is as full of purifier area as the work of construction could possibly admit.

The covers of the purifiers are perfectly flat, and strongly constructed of steel plates and channel steel, and T-steel trussing, with a strong steel curb round the outside. The interior arrangement of the purifiers consists of two tiers of wood grids, and T-bars for carrying them, supported on cast-iron standards. The top plates are efficiently supported by means of cast-iron square standards. The purifiers are worked by means of 20-inch trunk mains, and 18-inch branch mains, with 18-inch rack-and-pinion valves. By this arrangement, practically the purifiers may be worked any way. The valves are actuated from the floor-level—indicators in boxes let into the woodwork of the floor showing the operator precisely the position of the valves. The whole of the connections to and from the purifiers are at the bottom; and, in consequence of the elongated shape of the boxes, and to prevent short-circuiting of the gas from the inlets, cast-iron inlet-hoods are arranged inside the purifiers, to convey the gas to the centre of each before liberating it. In this way, an equal distribution of the gas is ensured. It was considered advisable to re-use the existing cover-lifting apparatus, which consists of a travelling frame, spanning the house, and running on rails attached to wooden beams carried on brackets fixed to the side walls of the house—the only alteration being that steel joists were substituted for the wood beams. The taking out of the old purifiers commenced, as stated, on April 1, and the new ones were at work, and all the accessory plant (yet to be described) established, early in October; so that the difficulty of the time-limit, which was one of the considerations affecting Mr. Smith's plans, was well surmounted.



Twenty-Four Brake Horse Power Gas-Engine and Bottom Portion of Elevator from Cross Conveyor, to Carry Spent Oxide to Revivifying-Floor.



Ground Floor of Revivifying-Shed, showing Elevator passing through the Floor to carry Oxide from the Bottom of the Boxes, and the Return Conveyor in the Distance for Refilling the Boxes.

To lead up to a description of the oxide-handling plant, we may introduce here some particulars of the new stage-floor revivifying-shed, the building of which has filled the space between, and conjoined, the two purifier-houses. The new building is about 167 ft. 6 in. long, 44 ft. 4 in. wide, and 20 ft. 6 in. to the underside of the gutter, and is covered with light corrugated iron roofs. The lower floor is about 2 feet below the purifying-house floor. The upper revivifying-floor consists of a series of transverse and longitudinal steel joists, supported by a line of columns down the centre, carrying the main joists. In between the longitudinal joists, which are framed into the transverse joists, are brick arches filled in with concrete on top, and neatly smoothed off level. Down the centre of the stage-floor is a double row of upright steel joists, which answer the dual purpose of carrying the roof and the longitudinal conveyor. At each side next the walls is a similar single line of joists arranged for carrying the outside of the roof principals. The principals are swept to a chord of a circle and covered, as previously stated, with galvanized corrugated sheeting—the rain water being carried into the existing gutters on the sides of the purifier-house and the valley gutter down the middle.

Now we come to what, in our view, is the most interesting part of the new installation—that is the plant for conveying, elevating, and distributing the oxide. The arrangement for discharging the oxide consists of two rectangular openings in the bottom plates of each purifier, placed at a centre distance one from the other of 20 feet. Descending to longcellar, it is found that the oxide is thrown on to two endless the itudinal plate belt conveyors, which travel the full length of the house, and are supported from the steel joists underneath the joints of the purifiers. The conveyors are on the tray system, and, by their means, any one purifier can be discharged in seven hours. The conveyors dispose of their load on to a cross conveyor of similar construction fixed at a somewhat lower level at the end of the house. Two streams of material feeding into this cross conveyor, it has to travel at a faster rate than the longitudinal ones

These conveyors are fitted with Dempster's patent parallel chain, running over double flange rollers, which prevent the trays catching the supporting framework. The cross conveyor delivers into an elevator-pit; and a bucket elevator carries the material up to the underside of the stage-house roof, where the load is transferred on to a longitudinal push-plate conveyor running down the centre of the house, and supported between the two rows of upright rolled steel joists, which are also used for carrying the roof. The conveyor trough has sliding doors arranged at regular intervals; and the oxide may be either distributed on to the lower floor by means of breeches shoots, or on to the top floor as desired.

The plant for returning the revivified oxide to the purifiers consists of an inclined push-plate conveyor fixed on the lower floor of the revivifying-house, about central between the eight purifiers. This conveyor (which is arranged to work at an angle of 25° to the horizontal) elevates and carries the oxide to the centre of the purifier-house. On either side of the conveyor head is a longitudinal conveyor of the push-plate type. At the present time, the one inclined conveyor elevates the oxide for one-half the purifiers—provision being made for extensions and duplicating and filling those boxes now being used for lime. Either of the delivery longitudinal conveyors is put into operation as desired by means of a clutch arrangement. For carrying the conveyors over the purifiers, the existing wood roof has been utilized to a large extent—the whole of the framework, &c., being carried from the ⊥ beams. From the conveyors, the material is delivered into the purifiers by means of light steel shoots.

The whole of the driving power is obtained by two horizontal "National" gas-engines—the one for the emptying plant being of 24 brake-horse power, and the other for refilling being of 12 brake-horse power. One of these is situated in a well-arranged basement chamber by the elevator-pit, and the other at the north end of the purifier-house, on the ground level.

This is a general description of a purifying plant which, we believe, is unique in this country, in that both the emptying and the refilling is accomplished by mechanical means; the only hand labour employed being the engine attendant and the men engaged in turning the oxide on the revivifying-floors and in its proper redistribution in the boxes. Standing in the midst of the plant, the question flashed across our mind, Will the day come when even this work will be accomplished by mechanical means? It is not so many years ago that one would have smiled at the idea of coal entering a retort-house, of that coal being carbonized, and of the resultant coke departing not only from the house but from the works untouched by hand. It is a common experience of to-day. Here in this purifying-house we see almost complete automatic conditions, the fulfilment of completeness only requiring the small links represented by the turning of the material for revivification and the spreading of the material in the boxes after revivification. Will these links ever be supplied? The whole plant for dealing with the material is essentially a time-saving one; and time in manufacturing operations represents money. But more about this presently.

During the inspection the writer was privileged to make for the purpose of this series of articles, Mr. Smith very kindly arranged for the operation of the whole of the oxide-handling plant, in order that he might be permitted to see the course of the oxide. Starting from the shallow cellar beneath the purifiers which is lighted by electricity (as by the way are the whole of the buildings connected with the work of purification), the longitudinal conveyors were seen coming along from out of the distance bearing layers of oxide, and delivering them into the endcross conveyor, which deposited its burden in the elevator pit. Then up by the bucket elevator it ascended to the push-plate conveyor running centrally under the roof of the stage-floor revivifying-house; and from this conveyor it was dropped on to the lower revivifying-floor by means of the breeches shoots. Now there is one thing of which anyone who has the opportunity of seeing this plant will speedily become convinced, and that is that the handling and passage of the material in this way has an important effect in producing quickly a partial revivification. The conveyance, raising, conveyance again, and the dropping in thin layers and small quantities cannot fail to produce it; and one sees that as the oxide drops from the shoots on to the lower revivifying-floor, it simply comes out in a thin, granular stream, which the slightest breeze scatters. Turning over some of the oxide which, the attendant stated, had not been touched from the time it had been deposited and levelled over the floor, there was very little difference between the under part and the surface.

But to proceed to complete the demonstration of the operations, Mr. Smith had a quantity of oxide placed on the ascending elevator to the longitudinal conveyor above the purifiers, and within a minute or two after we had reached the small converted house (in which are two of the eight purifiers) at the end of the main building, the oxide commenced to fall through the shoot on to the cover of one of the purifiers, which completed the whole cycle of the operations from purifier back to purifier. Having witnessed this, we can heartily compliment Mr. Smith and the Contractors on the splendid performance of the whole plant, which once set in motion, large though it is, accomplishes its duty with the regularity and constancy of clock mechanism. The whole apparatus is within the houses and so under cover; and every part is accessible for inspection and necessary attention.

It will be observed that nothing has been said here about lime purification. Some of the new boxes are at the present time being used for lime. But Mr. Smith is now revolving in his mind what he is going to do in connection with the old purifiers in the second house; and upon his decision on this point will also depend the situation of the lime boxes in the future. Therefore it is useless giving information as to what he is doing regarding lime purification during this (what may be called) period of transition.

There is only one point more, and that has to do with the question of the time saved by this plant; and "time is money." Mr. Smith says that, through the adoption of this machinery, his purification costs are the same as, if not less than, under the old system, and yet now he has these eight large boxes in place of the six small ones. In all there are eight men employed in the purification department—attending to the eight large boxes, the six small ones in the old house (the material for which is still dealt with by hand), and the machinery—and some of these men are at times available for work in other departments. Mr. Smith has timed the emptying of the large purifiers under the new conditions; and he finds that, starting at 7 o'clock in the morning, the unloading of between 70 and 80 tons of oxide can be accomplished by 3 o'clock. Chatting with the purifying foreman on the subject, he gave a little practical information from his actual experience. He confirms Mr. Smith that it takes them from 7 o'clock in the morning to 3 o'clock to empty a box, without the "bottoms"—*i.e.*, the oxide that has fallen through the sieves. The bottoms have to be removed in the ordinary manner, as the extra moisture picked up from the bottom of the boxes tends to clog up the conveyor. Without the machinery, the foreman says it would take the same number of men two days to empty the purifier, with the "bottoms." In charging the boxes, with the machinery and a "fair start" at 7 o'clock in the morning, he states that they can get the lid down again by 1.30 or 2 o'clock. ("But, of course," he added parenthetically, "there is an hour-and-a-half to come off that time for meals.") Charging by hand with the same number of men would require a day-and-a-half.

This completes the account of our survey of the new purifying arrangements and plant at Walsall. From every point of view, to use a trite but rather inadequate phrase in this instance, the work "reflects the greatest credit" on the Engineer as well as on the Contractors, whose prompt and energetic action enabled Mr. Smith to tide over a very anxious time. The different sections of the plant are illustrated by six photographic views.

Our final article will deal with miscellaneous work and apparatus, and the new workshops which have been executed and constructed, and the notice of which will end the account of Mr. Smith's first large scheme of changing from old to new the manufacturing conditions of the Walsall Gas-Works.

ELECTRIC LIGHTING MEMORANDA.

Metropolitan Tube Railways and Consequential Damages—The State of Electric Industry on the Continent—A Tale of Loss all round.

An important general ruling has been made by the House of Lords Committees who have had under consideration the various Bills for the new Metropolitan "tube" railways. It was announced by Lord Windsor, after consultation with Lord Ribblesdale and the Lord Chairman of Committees. The conclusion arrived at is that it is advisable to insert in all such Bills a general clause giving a limited period, possibly two years after the opening of the railways, during which all questions of damage arising from construction or working should be referred to a special tribunal, or to an arbitrator. Although it appears from the context that the class of damage which the Committees had in mind was subsidence and vibration, as affecting buildings on the line of route, the original terms are sufficiently wide to include the question of electrolytic damage. At least, this is the construction we should put upon the words "all questions of damage arising from construction or working," which are as broad as they could be. If this interpretation is the correct one, it will absolve gas and water companies from the expense and pains of opposing every Bill on clauses. It is true that Lord Knutsford has added an important statement to the original declaration, which seems to limit the protection to owners of buildings which had not been taken for the purposes of the railway. The proposed clause has not yet been drafted, and therefore speculation in regard to its scope is still free. It would be helpful meanwhile if somebody who knows would offer some brief statement as to how the law of compensation for damage by electrolysis stands, where there is no specific enactment on the subject. It is pretty obvious that if London is to be honeycombed with electric tube railways beneath the surface, and laced with electric tramways above, the electrolytic trouble is likely to become acute; while the difficulty of proving specific injury, and bringing it home to perpetrators, will be insuperable.

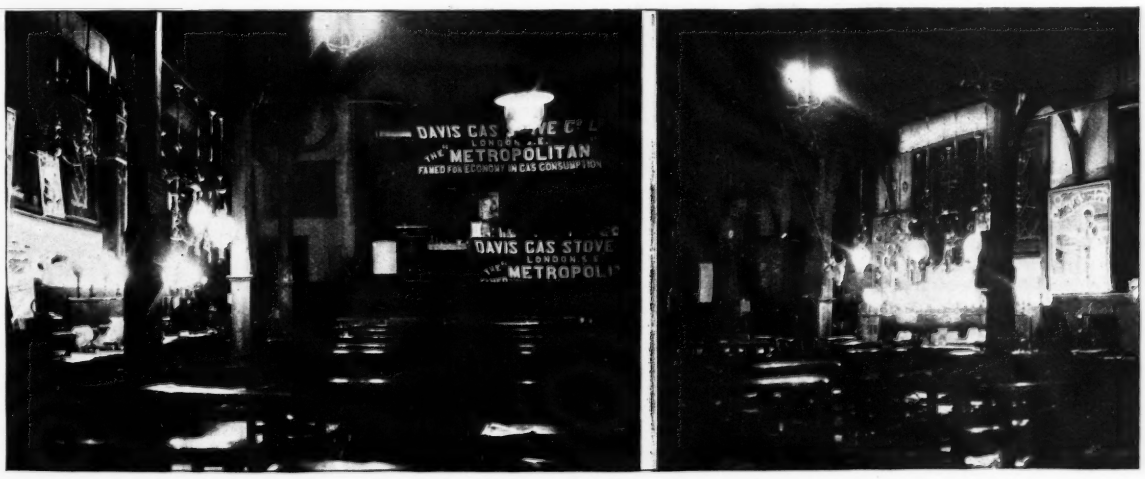
The current issue of the "Electrical Review" contains a highly instructive report on the actual condition of the Continental electrical industries. In view of the "scare" statements that British newspapers are so fond of publishing in regard to the marvellous progress of these industries in Germany and Central Europe, it is reassuring to learn that this rapid growth is not all to the good. It is understood that electrical speculation on the Continent has outgrown itself for the time being under the forcing influence of reckless financing; but the gravity of the situation is scarcely realized outside the countries affected. It is reported

that so severe is the depression of the electric engineering industry in Germany, that even companies of the first rank are refusing further heavy commitments. "Among the contracts in question may be mentioned the equipment of a generating station at Lodz, and the construction of electric tramways at Warsaw and Lublin, all three of which have been declined by two Teutonic Companies working in Berlin and Frankfort respectively. And the prices obtainable are so bad that it is feared they will prejudicially affect manufacturing companies in the current financial year." Last year was bad enough for most of them. The Directors of the Electric Investments Company of Cologne, which closed its financial year last June with a loss of £250,000 on a capital of £750,000, have been busy for months on the elaboration of a reconstruction scheme. Intimately associated with the Helios Company, chiefly known for its pretty arc lamp advertisements, the Company has now approved a scheme for reducing the share capital by one-half, and for the issue of 6 per cent. preference shares to the extent of £250,000. The Company for Electrical Enterprises, of Berlin, has experienced a severe set-back during the year. Its share capital has remained stationary at £1,500,000 for several years past, and there is a bond issue which was increased from £1,500,000 in 1890 to £1,750,000 last year. The Company are interested in a considerable number of lighting, tramway, and other undertakings in Germany and elsewhere; and the net profit realized last year amounted to £64,293, as compared with £143,743 in the previous year. Consequently, the dividend has fallen to 4 per cent., as against 8 per cent. in 1900, and 10 per cent. for the two preceding years. In explanation of this retrogression, the report of the Directors remarks that the economic depression has unfavourably affected a large number of the undertakings in which the Company are interested. The high state of prosperity enjoyed by the great Berlin firm of Ludwig Loewe & Co. has also suffered a severe check; the year's net profits having dropped from £99,033 to £51,114. The German Babcock and Wilcox Boiler Company do not seem to get on, either, having realized last year a net profit of only £65.

Matters are no better outside Germany. While such desperate efforts are being made in England to "boom" electric tramways, it is a little disconcerting to learn that the General Traction Company of Paris has dropped £800,000 for the past year. The Swiss concern known as the Alioth Electricity Company, of Arlesheim, near Basle, has closed the year with a debit balance of £138,000, which is more than one-half of the share capital. It is scarcely necessary to remark here that coalless Switzerland has always been held up to the admiration of backward England as a bright example of what can be done with industrial electricity. On the other hand, the Neuhausen Aluminium Company, and the Oerlikon Accumulator Works are paying good dividends. The Russian Siemens and Halske Company are experiencing heavy weather, and can only pay a dividend of 2½ per cent. As regards electrical improvements, the report remarks that the outlook for the osmium lamp is far from bright. It is a long time in making its appearance in the market; and there is no denying the truth that the metal osmium is both scarce and dear. The Nernst lamp is still struggling through the German Patent Office; and the issue is uncertain. Well might it be said that "the position of the Nernst lamp and the osmium lamp is attracting a considerable amount of attention." Something good and fresh is evidently wanted badly to restore the fortunes of the Continental electric industries; but whether this will eventually come in either shape of the new lamps which have twinkled so long on the industrial horizon may be questioned.

PHOTOGRAPHY BY INCANDESCENT GAS-LIGHT.

One of the features of the recent Gas Exhibition held at Hertford, under the auspices of the Gas Company, were the examples of new forms of incandescent gas-lights. A specimen of the Lucas lamp, giving the powerful light of 700 candles for an expenditure of 17 cubic feet of gas per hour (and costing, at the present price of Hertford gas, ¾d. per hour), was a great attraction. A Welsbach self-intensifying lamp, affording a light of between 250 and 300 candles, and consuming 10 cubic feet of gas per hour at



a cost of less than ½d., was also on view. In addition the hall was lighted by four Kern burners, giving together the brilliant light of 1300-candle power, at the moderate cost of 2d. per hour. There was also a side-show of various incandescent burners. In order to test the general lighting effect in the hall, Mr. R. Watson (the Gas Company's Engineer) experimentally took two or three photographs of the interior at night with no other lights going than those mentioned, and, of course, without any special preparation or arrangement for photographing any particular object. We reproduce two of the photographs. They are of interest, as they show what can be done under ordinary conditions with incandescent gas lighting in photography. But they must not by any means be taken as specimen results of work that can be executed with a proper arrangement of incandescent gas-lights and screens. Very beautiful work—exceeding in the fineness of detail, some people are convinced, that done by the electric light—is now accomplished by incandescent gas lighting.

ITALIAN GAS SOCIETY.

Encouragement to its "Sons of the Gas Industry."

At last year's meeting of the Italian Gas Society, held in Florence, a Committee was appointed to consider what steps might be taken in order to increase the interest of the annual discussions, and also to encourage younger gas engineers to give more study to the various technical problems confronting the industry. We have just received this Committee's report, signed by its five members, Sigg. Rebuffel, of Bologna, Mariani, of Turin, Pouchain, of Rome, Pérouse, of Naples, and Sospisio, of Trieste. They propose, briefly, to follow in the footsteps of the Société Technique de l'Industrie du Gaz en France, and to offer inducements, in the shape of medals and monetary prizes, to members and others to contribute papers to their proceedings. It is suggested that there should be two categories of competitions. The first, for members only, is made up of the ordinary class of papers presented each year, for the best of which either a silver medal and 500 lire (£20), or a bronze medal and 200 lire (£8), will be awarded according to merit. This, it is hoped, will induce many of the members—the younger ones in particular—to show their abilities in the way of technical contributions. The other competition proposed is open to all-comers of every nationality. It will be triennial, and will consist in an essay to be written on a subject set by the Society, or in the improvement of some gas apparatus, as may be determined. The awards in this case will be either a gold or silver medal, accompanied by 1000 or 500 lire (£40 or £20) respectively.

To meet the financial requirements of the proposed prizes, the Committee are desirous of avoiding any increased annual subscription; and it is remarked that, as gas companies and their works will really benefit more by the investigations made and the papers prepared than the members of the Society, it is only logical that the former should be asked to bear the cost. The works represented by the Italian Gas Society have an annual make of more than 110 million cubic mètres of gas, or something approaching 4000 million cubic feet. It is proposed, therefore, to seek contributions from the different gas companies at the rate of 15 lire for every million cubic mètres of gas made per annum. This is, roughly, the equivalent of 4d. per million cubic feet. By these means, an incentive will be given to engineers to express in technical communications their continued studies of gas subjects,

and, both individually and collectively, profit will result therefrom. As we are always glad to hear of anything in the way of encouragement proferred to the junior branch of the gas profession, wherever it may be located, we heartily welcome the scheme, and hope and believe that our Italian friends will increase the strength, number, and influence of their Society accordingly.

The Committee's report will be the subject of discussion at the next meeting of the Italian Gas Society, which will take place next month at Turin, under the auspices of Sig. Beria, the Manager of the Società Consummatori Gas Luce in that town. It had been arranged to hold this year's gathering at Palermo; but, owing to the works there being in a state of reconstruction, it has been decided to change the rendezvous to the Piedmont capital.

AN ELECTRICALLY PERFORATED GAS-MAIN.

THE photograph which we reproduce here will be examined with considerable curiosity; and for it readers are indebted to Mr. Charles Wood, the Engineer and Manager of the Bradford Corporation Gas Department. It is a remarkable piece of evidence from that city as to the grave danger which is now threatening gas and water mains by the great electrical traction systems which are daily on the increase throughout the country. The gas-main illustrated is a 12-inch one, and the two ugly, gaping apertures are the result of the fusing of an electric tramway cable on the 18th inst. The cable had been laid close to the gas-main at this point;

THE DAMAGED 12-INCH GAS-MAIN.

and when it fused, Mr. Wood says, "it melted up the earthenware pipes, bricks, and stones, but fortunately did not ignite the gas." This shows the brilliant chance that gas-mains have in the face of an accident of this kind. The character of the holes in the gas-main are of interest. The one on the right-hand side, it will be observed, is a clean, straight-cut through the metal, and the aperture on the left-hand side is much of the same kind, but appears to have a good deal of surrounding pitting. The photograph was taken *in situ*. This must have been rather a troublesome job; but our illustration shows that it was very successfully accomplished. In this, Mr. Wood has indeed done great service to the gas industry, and has supplied a strong lever with which to help forward the claim of gas undertakings to protection in connection with electrolysis. We undertake to say that more will be heard of this Bradford example of the gravity of the growing danger.

A wooden chimney-stack, 160 feet high, is in operation at Mapimi, in the province of Durango, Mexico. The interior is lined with corrugated iron, and there are platforms at intervals to throw water on the wood if it catches fire.

Among the exhibits at the first *soirée* of the Royal Society, held last Wednesday week, were some beautiful and delicate ones by Mr. George Beilby, whose name is known to most readers of the "JOURNAL," showing the film structure in metals and other plastic solids. Metal surfaces are covered with a transparent, lacquer-like film of their own substance, which is formed by the welding together of minute reflecting films or "spicules;" and these are specially well seen in surfaces which have been frosted by heat and chemical reagents. The direct projection of some of these metal surfaces, at magnifications of from 500 to 1000 diameters, when thrown upon a screen, were very striking—the films looking like the down on a butterfly's wing. It appears that the investigation in this direction is new. A new form of the Thomson coal calorimeter was exhibited by Mr. W. Rosenhein. It is said to be more accurate in determining the calorific value of coal, more easily manipulated, and more speedy in action than the ordinary instrument. The Badische Anilin und Soda Fabrik, Ludwigshafen-on-the-Rhine, had an exhibit of synthetic indigo, consisting of (*a*) specimens of the raw material (naphthalene) and the intermediate products formed in the manufacture of synthetic indigo, as well as of the latter in four different forms; (*b*) examples of various textile materials illustrating the application of synthetic indigo on loose wool, slubbing, military cloths of different nations, cops, cross-reeled bundles, and cotton piece goods.

PERSONAL.

Mr. E. J. FUSSELL, formerly of the Tiverton Gas-Works, has been appointed Secretary to the Nantwich Gas Company.

Viscount HAMPDEN, G.C.M.G., has been elected Chairman of the Lambeth Water Company, in the place of Mr. Herbert G. H. Norman, lately deceased.

On the recommendation of Mr. H. Townsend, Manager of the Wakefield Gas-Works, Mr. LAURIE WHITAKER, one of the staff, has been promoted to the position vacated by Mr. W. W. Townsend, who has gone to Colombo.

The Southport, Birkdale, and West Lancashire Joint Water Board have appointed Mr. H. WATCHORN Manager and Accountant, and Mr. ABBOTT Resident Engineer. Mr. Henry Rofe, M.Inst.C.E., the late Manager, has now retired from the service of the Board.

Mr. ALFRED B. TOBEY, Assistant-Manager at the Scarborough Gas-Works, has been appointed Manager at Durham, in succession to Mr. E. H. Millard. There were between 40 and 50 candidates for the position, advertised in the "JOURNAL" a fortnight ago. Mr. Tobey has been at Scarborough for five years.

The retirement of Mr. J. H. Campion Coles from the position of Secretary and Accountant of the Eastbourne Gas Company has already been announced in the "JOURNAL." His duties will cease on the 30th prox., and he will be succeeded by Mr. J. S. GARRARD, who has for many years been Chief Clerk in the Light Office of the Cheltenham Gas Company. There were 135 applicants for the post.

Mr. W. W. TOWNSEND, who, as our readers may remember, has been appointed Assistant-Manager of the Colombo Gas-Works, was recently the recipient of a testimonial from the employees of the Wakefield Gas Company, of which his father, Mr. H. Townsend, is Engineer and Manager. The occasion was a "high tea," of which 97 of the workpeople partook at the invitation of this gentleman, who presided, in the unavoidable absence of Dr. Statter, the Chairman of the Company. Mr. Goldthorp, a Director, made the presentation, which consisted of a gold keyless chronograph, bearing the following inscription: "A token of esteem to Mr. W. W. Townsend, from the officials and workmen of the Wakefield Gas Company. May 14th, 1902." In acknowledging the gift, Mr. Townsend expressed the hope that, in the new sphere to which he was going, he should find as good workmen as those he was leaving behind. The gathering was an exceedingly pleasant one, and was enlivened by selections of vocal music. Next morning Mr. Townsend left Wakefield for London (a number of the workpeople giving him a hearty send-off); and on the 16th inst. he sailed for Colombo in the *Gourka*. Our best wishes go with him.

OBITUARY.

WILLIAM REGINALD CHESTER.

It is with sincere regret that we have to record to-day that the serious illness from which, as our readers are aware, Mr. W. R. Chester, of Nottingham, has lately been suffering, terminated fatally last Saturday morning. It may be remembered that early in the year Mr. Chester was troubled with what was thought to be an affection of the sight, for which rest and change were prescribed. He accordingly went to Bournemouth, but after a few weeks returned to Nottingham little, if at all, benefited. It was then deemed expedient to have further medical advice; and when it is mentioned that the specialists consulted were Sir William Gowers and Mr. Victor Horsley, the grave nature of the case will be fully appreciated. Their pragnosis, though justifying hope, did not give very much ground for confidence. Hope was, however, encouraged by the fact that the patient was able to take nourishment, and was not in pain. In these circumstances, Mrs. Chester thought it advisable to have a third specialist (Dr. Ferrier) down from London. He confirmed the opinions of the two distinguished practitioners above named as regards the nature of the case, but held out a strong hope that an operation might be successful. Both he and Mr. Horsley, however, agreed that it would have to be performed in London, in order that they might be in constant attendance upon the patient afterwards, which is really the critical time. Mr. Chester was accordingly removed to the Metropolis last Wednesday, and bore the journey remarkably well. It was arranged that the operation should be performed on Saturday; but on the previous day Mr. Chester was seized with coma. The three specialists were with him within an hour, and they thought he would rally; but he never regained consciousness, and died at four o'clock on the morning of the 24th inst. Although the end had been expected at any moment, it nevertheless came with a great shock to Mrs. Chester, especially as—her husband not having suffered pain for some weeks, and was conscious—her hope that he might eventually get well was strengthened. This, unhappily, was not to be. The body was taken to Nottingham late on Saturday night; and the funeral will take place to-morrow, at the Church Cemetery, Nottingham. The cortège will leave the residence of the deceased (The Woodlands, Mapperly Hill) at 12.30, and the service will be held at St. Andrew's Church about half-an-hour later.

Mr. Chester was born at Shepshed, in Leicestershire, in 1855, and was therefore only 47 years of age when he died. On leaving

school, he was articled to Mr. P. J. Wates, Engineer and Manager of the Loughborough Gas Company. When Mr. Wates left for London, to take charge of the Greenwich station of the Phœnix Gas Company, Mr. Chester went with him. On the amalgamation of the Company with the South Metropolitan Gas Company in 1880, Mr. Wates was placed in charge of the Vauxhall works; and his former pupil became his assistant. Shortly afterwards the latter obtained the appointment of Manager of the Rochdale Road works of the Manchester Corporation, under Mr. John West, the Chief Gas Engineer. Two or three years later he was removed to Gaythorn Road; and subsequently transferred to the new works at Bradford Road. In the meantime, Mr. West had resigned his position, in order to devote himself to the establishment of the business at Miles Platting with which his name has ever since been associated. During Mr. Chester's period of service with the Manchester Corporation, he had an excellent opportunity of studying mechanical stoking; and he made good use of the knowledge he gained there. In 1888, Mr. Lewis Thompson Wright relinquished the position of General Manager of the Nottingham Corporation Gas Department in order to proceed to Buenos Ayres; and Mr. Chester was selected to succeed him. In noticing the matter at the time, we remarked that the new Manager's antecedents rendered him specially suitable to take charge of the important works which Mr. Wright had conducted with so much ability; and we thought there could be no reason to doubt that, in his successor's hands, they would continue to furnish a very substantial amount of profit to their owners. Those who have followed the progress of the Nottingham gas undertaking since then will be able to form an estimate of the extent of Mr. Chester's labours in connection with it. Briefly put, they amount to a complete overhaul of the plant in order to bring it abreast of the times, and make it equal to the demands upon it in consequence of the widely extended use of gas in the district served.

In the early days of his professional life, Mr. Chester was impressed with the value of association with his colleagues for the enlargement of his ideas; and therefore we find him in 1878, when at Greenwich, joining the British Association of Gas Managers. Eighteen years later, he found himself at the head of that organization, transformed into the Gas Institute. In the meantime, he had been no silent member—acquiring knowledge, but imparting more—for he had contributed several valuable papers to the "Transactions." In the year 1891 he dealt with the utilization of the bye-products in the manufacture of coal gas in such a manner as to gain for him the third prize. The following year, he read a paper on "The Structural Capacity and Cost of Gas-Works," which brought him the second premium. In 1894, he discoursed on the subject of "The Construction and Working of Regenerator Settings of Retorts," for which he received a similar award. In 1896, at the meeting of the Institute in London, he filled the Presidential Chair, and delivered a very interesting address. The next year he came forward once more with a paper on "The Automatic Regulation of Pressure in Distributing Mains," and received for it the third prize. Two years ago he contributed an important paper descriptive of the automatic stoking machinery and inclined retorts at Nottingham. It was accompanied by a large number of plates; and for it Mr. Chester had the gratification of receiving the Institute's first prize —the President's Medal and £10. Apart from his technical contributions, Mr. Chester took a conspicuous part in the general discussions. On the amalgamation question, he displayed great interest; and it will be in the recollection of our readers that, when the subject was under discussion at the meeting last year, he proposed a resolution, which was adopted practically unanimously, endorsing the efforts of the Council to bring about a union of the two Societies, and requesting them to continue their efforts, "on the basis of the inclusion of all classes of existing members" of each. Reference to these bodies affords a convenient opportunity for mentioning the practical paper he contributed to the Gas Section of the Engineering Congress last year, on "The Mechanical Transport of Materials in Gas-Works."

Mr. Chester did not confine himself to the Gas Institute. He became a member of the Manchester District Institution of Gas Engineers in 1882, and rose to the position of President in 1893. Three years previously he read a paper on "The Supply of Steam to Regenerator Furnaces"—a subject with which his name has been for some time associated. In 1892, he gave an interesting account of an explosion which occurred in a tar-well. In the year of his presidency, in addition to his Inaugural Address, he furnished some notes on the Nottingham Gas Supply. In 1894, he dealt with the subject of the heating of greenhouses and conservatories by coal gas; but, owing to the serious illness of the first Mrs. Chester, he could not be present to read it. At the first meeting of the Institution in the following year, he was able to attend; and he then furnished some additional particulars. He was also a member of the Midland and Eastern Counties Associations—having been elected to the former in 1889, and the latter in 1897; but we do not find he contributed much to their published proceedings.

Mr. Chester acquired status as an engineer by being admitted a member of the Institution of Civil Engineers in 1894 without having first passed through the usual period of associate membership; and his advice and assistance were frequently sought in connection with parliamentary inquiries and arbitrations. He was by no means devoid of inventive capacity; our "Register of Patents" for the past twelve years showing several instances of his ingenuity. The subjects to which he directed his attention included recording the pressure of gas, registering the supply of lubricating oil to gas exhausters, indicators for gasholders, and a hopper and shoot for gas-retorts. He was a systematic reader of technical literature, and an industrious compiler; one of the most noteworthy examples of these qualities being furnished in his "Bibliography of Coal Gas," which was brought out in 1892. He commenced this work in 1884; and in it were indexed the chief subjects dealt with in the 24 volumes of the "JOURNAL" from 1880 to 1891 and in other publications, including the "Transactions" of the two parent Societies. It was his intention to continue the work at some future time; but the hand which would have executed this useful task is now still for ever.

In closing this notice of Mr. Chester's life-work, we can only express regret that it has come to an end so prematurely; and we unite with that expression our sincere sympathy, which will, we are sure, be shared by a large number of our readers, with Mrs. Chester and the family in the great bereavement they have sustained.

The death occurred on the 17th inst. of Dr. RICHARD PITT, Chairman of the Wellesbourne Gas Company. The deceased gentleman was 84 years of age, and had lived and practised in the village for the long period of 61 years. He was the oldest member of the British Medical Association, both in point of age and membership.

NOTES.

The Separation of Hydrogen from Coal Gas.

It is reported that a use for liquid air has been found by M. D'Arsonval, in the separation of hydrogen from coal gas. The process was recently mentioned by the author in the course of a lecture on liquid air and its applications, delivered before the Société Internationale des Electriciens. Numerous interesting phenomena noted at the extremely low temperatures obtainable by the use of liquid air were mentioned by M. D'Arsonval; among others, the fact that the most powerful explosive now known is a mixture of liquid ozone and solid acetylene, both being endothermic bodies. The method of preparing pure hydrogen from coal gas is by a system of fractional distillation at low temperatures. It is stated to be very economical where large quantities of pure hydrogen are required; but, so far, no details of the mode of working have transpired. It is, at any rate, a very unexpected utilization of liquid air. Incidentally, M. D'Arsonval remarked that certain of the lighter petroleums, separated out by fractional distillation at low temperatures, are perfectly fluid at — 190° C., and are suitable for use in the construction of low-temperature thermometers. The idea of fractional distillation of fluids and gases at extremely low temperatures, being the converse of ordinary distillation, is attractive.

Efficiency of Incandescent Electric Lamps.

Electricians commonly protest when gas engineers assume, for the purpose of comparing the duty of incandescent electric lamps with that of gas-burners, that the former require an average current of 4 watts per candle power. In a special account of the manufacture of such lamps by the Incandescent Electric Lamp Company, at Brook Green, W., just published in the "Electrical Review," may be found proof of this contention. Describing the processes which go to the manufacture of a "Robertson" lamp at these works, the following general terms apply to the photometric work, which is done by women. Every lamp is tested at a standard efficiency of 4 watts per candle—the candle power and voltage at this rate being marked in ink on the bulb. The photometer used is a simple Joly screen, with a direct-reading scale; the standard is a Vernon-Harcourt pentane flame, with Methven screen. The operator is seated with the photometer head before her, and makes the necessary adjustment by means of a rack and pinion, which moves the lamp under test. The scale of the photometer and that of the wattmeter are close together in front, so that she can readily ascertain the candle power and compare it with the power absorbed. If the candle power is not four times the watts, the operator varies the voltage until the two values are in agreement. An assistant then reads the voltage, and marks it, together with the observed candle power, on the bulb. The lamps themselves are carefully screened from direct view while the test is being made. The interest of this account is in the standard of voltage observed, which amply justifies all the "JOURNAL" has ever maintained on the subject.

Carbide and Acetylene Apparatus in Germany.

According to Dr. A. Frank, in a recent communication in the journal "Acetylene," there must now be in Europe 170,000 to 200,000 horse power allocated to carbide manufacture. But at the most, 20 per cent. of this would be in working at the present time. The amount of light produced by 200,000-horse power, when rendered into acetylene, would correspond to that of 300,000 metric tons of petroleum. Germany alone imports 9 million tons of the latter. Germany has the highest consumption

of carbide; her total requirements being estimated by Dr. Frank at 15,000 metric tons. The chief consumers are the railway companies, which take from 10,000 to 12,000 metric tons for the manufacture of mixed gas. While acetylene central supply works, of which there are 100 altogether, and 40 in Germany alone, are technically and financially satisfactory, the erection of single apparatus is attended with great difficulties. Dr. Frank discusses the oft-mentioned grievances connected with the manufacture of apparatus, and glances at the measures taken by the German Acetylene Union to remedy these grievances. He discusses the standards for the carbide traffic, and for the erection and installation of acetylene works, introduced by the Union. The Bavarian regulations interfere with the sale of apparatus, and render the erection of automatic generators, which are much in favour for small installations, almost impossible. In spite of these obstacles, acetylene lighting is steadily extending, as it is particularly well fitted for photographic workshops and lighthouses, owing to the advantage of the colour of its light being similar to sunlight. The introduction of incandescent lighting with acetylene is also acting favourably. This system effects so great a decrease in consumption that, per unit of light, 1000 cubic feet of acetylene, taken at £2 5s. 3d., can compete with coal gas costing 5s. 8d. per 1000 cubic feet. For competing with air-gas, which can be used quite well under certain conditions, acetylene is carburetted.

TECHNICAL RECORD.

WATER GAS MANUFACTURE IN THEORY AND PRACTICE.

By Dr. J. Kramers.

[Abstract Translation of a Communication published last year in "Het Gas."*]

(*Continued from p.* 1351.)

The Action of Water Vapour on Carbon.

According to Lang, the action of H_2O on C begins below 600°C.; and if steps are taken to ensure that the temperature does not rise, CO_2 and H_2 exclusively are obtained. Therefore, it may be supposed that the reaction takes place as follows:—

$$C + 2\,H_2O = CO_2 + 2\,H_2 \quad (18)$$

The assumption that CO would first be formed, and that this would be oxydized by the water vapour present, so that there would be obtained, first:

$$C + H_2O = CO + H_2 \quad (19), \text{ and afterwards}$$
$$CO + H_2O = CO_2 + H_2 \quad (20)$$

which, as far as the final result is concerned, is the same, is disproved by the fact that, as will be shown later, the reaction (20) does not take place perfectly at this low temperature (under 600° C.). There is, therefore, no alternative but, at this temperature, to refer to reaction (18). With a rise in temperature, CO appears; and this percentage of CO increases with the temperature, as Lang has shown. The proportion of CO_2 is still very large, even with a very high temperature; but that must be ascribed to Lang having used a large excess of water vapour, whereby reaction (20) becomes, as a secondary reaction, of great influence. The CO_2 cannot be made to disappear entirely, even if very little water vapour be taken, and the action be prolonged. This is shown by another test of Lang's, in which he passed a mixture of nitrogen and water vapour twenty times over incandescent carbon at about 1000°C., when finally the composition became:

1·2	per cent.	CO_2
29·6	,,	CO
30·3	,,	H_2
38·9	,,	N_2

An experiment of Lang's, in which he heated a mixture of CO, H_2, and N_2, will be reverted to later. It is to be regretted that Lang carried out the experiments with a small proportion of water vapour, and only at one temperature, and thus only answered very incompletely the fourth question of Naumann. This is perhaps why Bunte, convinced of the importance of the question in regard to the water-gas process, had a series of experiments made six years later by his pupil Harris. Water vapour was passed through a pipe filled with charcoal and heated from outside. The quantity of water vapour which was not decomposed, and the remaining constituents of the gas formed, were determined in the usual manner. The results are to be found in a table given in the "Journal."†

The experiments of Harris supplement those of Lang. The proportion of CO_2, as well as the quantity of undecomposed water vapour, decrease with an increasing temperature. Harris did not completely investigate what influence a change in the rate of flow of the steam has; he merely confirms the statement that this rate can be increased, as the temperature becomes higher. At 1060° C., the speed was ten times greater than at 674° C. Yet there was at 674° C. ± 30 per cent. CO_2, and at 1060° C. only 1·3 per cent. That the temperature is a chief factor is best seen from a comparison of Harris's tests No. 6 (at 954° C.) and No. 7 (at 1010° C.) The rates of flow of the steam in these are nearly the same (6·3 and 6·15); while both the percentage of CO_2 (6·8), and that of undecomposed water vapour (27·2) in No. 6, are more than four times greater than in No. 7 (CO_2 = 1·5, water vapour = 6·0). Everything shows that an effort must be made to maintain a temperature above 1000° C.

The researches of Strache, which have been reported in the "Journal,"* remain to discuss. They are particularly interesting, as they were not laboratory experiments, but trials with a water-gas apparatus, operated by the inventor himself, and therefore under the most favourable conditions for the apparatus. On this account, his results may appear somewhat rose-coloured. Strache's conclusions, when they do not agree with those of other observers, will fairly be open to severe criticism. Strache comes to the conclusion that, *cæteris paribus*, the percentage of CO_2 decreases with an increasing temperature. This percentage is, however, according to Strache, in a large measure dependent on the rate of flow of the steam. The most favourable rate may be put at about 6. This is a relative number, and has only practical value for a particular Strache apparatus. It has no theoretical value; and it can only be concluded that with a particular Strache apparatus there is a fixed rate of flow of steam, which is the most favourable. Scarcely anyone would doubt this.

It is strange that Strache communicated no results of trials made at this most favourable rate "6"; but only an experiment at a rate of flow of 4·4, and afterwards one of 7·5 are recorded. This last number comes somewhat nearer to 6 than the first, and might therefore be considered rather more closely. But, unfortunately, the temperature of the generator is not stated with this experiment. Recourse must therefore be had to the experiment carried out at a rate of 4·4.† A closer consideration of the trial at the most favourable rate would have shown that Strache, at a given moment, had 15·6 per cent. of CO_2 in the water gas under trial, and the not unimportant amount of 62·1 per cent. of undecomposed steam. From Strache's table of observations at the rate of flow of 4·4 (see Diagram B *loc. cit.*), we remark: (1) That the temperature of the generator must represent the mean temperature, and (2) that this is not directly observed, but calculated in a very complicated manner. The data do not admit of this calculation being checked. But, assuming that it is correct, there must certainly have been a hot and a cold part in the generator; and that being so, it is still more inexplicable how the temperature of the escaping gas could be so low, especially as the gas as a rule comes into contact last with the hottest part of the generator.

The incredibly low temperature of the gas is the reason why the losses (as calculated) are very small relatively to the large proportion of undecomposed steam after the 16th minute—particularly when, as is Strache's practice, the cost of steam is not taken into account. The 45·5 per cent. of undecomposed steam apparently does not carry off more calories than are required to heat this 45·5 per cent. of steam at 144° C. (assuming steam at 4 atmospheres pressure to be used) to 415°C. The calculation becomes quite different if the calories required to convert the 45·5 per cent. of water at 0°C. into steam at 144°C. are not neglected. If steam costs nothing, 40 to 60 per cent. of undecomposed steam could be allowed in the gas without very great loss; but all who use Strache's apparatus, and have to make and pay for their steam, would be well advised, under the given conditions, to stop making gas after the 6th minute, and then heat up the generator again by a few degrees.

Strache confirms the fact that the percentage of CO_2 diminishes with increase of temperature, and that with every apparatus there would be a fixed rate of flow of the steam which would be the most favourable. With the relatively low temperature of 860°C., a practicable rate of flow could be found, at which virtually only 2·2 per cent. of CO_2 and 4 per cent. of undecomposed steam would appear, and at which the temperature of the gas, on leaving the generator, would be only 390° C.

The results of the experiments of Lang, Harris, and Strache are collected in the diagram, fig. 1.

Strache's figures are taken from his trial at a rate of flow of 0·58,‡ which is more unfavourable as regards the make; but the temperatures at which a small proportion of CO_2 appeared were somewhat lower. The experiments of Harris and Lang agree so well up to 840° C. that they seem like two series by the same experimentalist. Above that temperature, great differences occur, which must be attributed to the large amount of water vapour employed by Lang, whereby the reaction $CO + H_2O = CO_2 + H_2$ becomes of great influence.

It is clear from the diagram how very different are Strache's results. According to him, all is explained by the difference in the rate of flow of steam. It might still be shown theoretically that Strache's result likewise conflicts with the researches of Lang and Rathke when they were studying the action of CO_2 on C. The application of Strache's discovery would be simply

* The author has used throughout chemical symbols in place of the names of elements and compounds; and though such use is open to serious objection, and is contrary to our usual practice, it has been retained *for the sake of brevity* in this translation.—Ed. J.G.L.

† Vol. LXIII. p. 484.

* See "Journal," Vol. LXVII., pp. 27, 87, 145, 208, 275, 401.

† *Ibid.*, Vol. LXXVII., p. 275. ‡ *Ibid.*, Vol. LXXVII., p. 275. Diagram A.

ACTION OF H_2O ON C. THE PROPORTION OF CO_2 IS CALCULATED ON THE TOTAL QUANTITY OF $CO_2 + CO$.

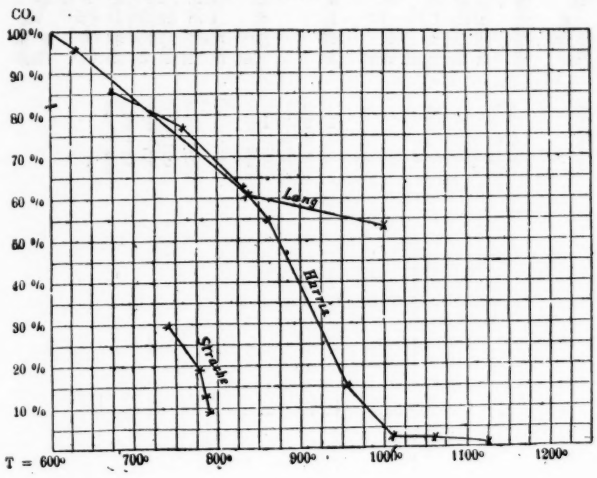


FIG. 1.

this: With apparatus having small duty, the steam-cock should be set half-open during the gas-making, and gradually closed. It is to be feared that thereby the output of the apparatus would diminish so much that one would be inclined again to blow the generator as hot as possible. This is the opinion of all experimentalists and constructors of plant, with the single exception of Strache. A high temperature in the generator (preferably above 1000°) has therefore to be aimed at. This temperature would decrease during the continuance of the run; but the apparatus cannot be at once changed to the blast or blow, because the number of periodic changes would be so great, and the quality of the gas would in consequence suffer. Thus the apparatus is, after the blow, filled with producer gas (chiefly N_2 and CO_2), which cannot be got out of it—at least, not so far as the N_2 is concerned, the CO_2 could be converted into CO—and therefore gets mixed with the water gas, as soon as the change is made to the run. The less of two evils must be chosen; and therefore the run must be continued for a time, even after the most favourable temperature is passed, and practically there will always be left in the gas some undecomposed water vapour besides CO_2. Whether there must necessarily be any *determinable* quantities of CO_2 and undecomposed water vapour in water gas will be discussed later.

There is now to be considered what effect these two constituents of the water gas, as it leaves the generator, have on the other constituents of the gas formed. Let us take first

THE ACTION OF CARBONIC ACID.

Between CO_2 and CO a reaction can scarcely take place having any influence at all on the composition of the gas. The action of CO_2 on water vapour need not be considered. There remains the action of CO_2 on the H_2 present. This is covered by the second question of Naumann and Pistor, which they answered. Theoretically, reaction is not excluded. It is always possible that $CO_2 + H_2$ will change to $CO + H_2O$. Naumann and Pistor passed, at gradually increasing temperatures, a mixture of 1 part of CO_2 to 3 parts of H_2, through a tube filled with small pieces of pumice stone, which thus presented a large surface. There was no reaction, even when the tube was heated to the melting point of silver (954° C.). It may therefore be assumed that, under ordinary circumstances in a generator, no action takes place between carbonic acid and the other components of water gas. What would happen with very high temperatures (which do not occur in the generator), will not be discussed at present. Practically the reaction is

$$CO_2 + H_2 -> CO + H_2O.$$

It is so small at the temperatures coming into play, that it may be neglected; but it will be considered theoretically later.

THE ACTION OF THE UNDECOMPOSED STEAM.

Here the reaction $H_2O + CO -> CO_2 + H_2$ alone calls for attention. An action of H_2O on H_2 leads to the same substances; and an action of H_2O on CO_2 is likewise to be looked upon as CO_2 on H_2O. The reaction $H_2O + CO -> CO_2 + H_2$ was examined by Naumann and Pistor. They found that at a temperature lying between 530°C. and 585°C., no action took place. Action began, however, between 602°C. and 634°C., and increased as the temperature rose; so that, at last, at the melting point of silver (954°C.), about 10 per cent. of CO_2 was found in the mixture, after it had passed once through the tube. Bearing in mind that at a particular temperature no determinable reaction in the sense of $H_2 + CO_2 -> H_2O + CO$ takes place, as was indicated by the above-mentioned researches of Naumann, then it is not clear, *a priori*, why a portion of the mixture was not reconverted into $CO_2 + H_2$ when the mixture was again passed through the heated pipe; or in other words, whether the reaction would not lead to the practically general conversion into CO_2 and H_2. Lang tried to show that the reaction $CO + H_2O - > CO_2 + H_2$ is not complete below 1000° C., but approaches to a determinable limit. It must thus, perforce, be accepted that, with a fixed temperature below 1000° C., and a fixed percentage each of CO_2, CO, H_2 and H_2O in the gas, an equilibrium is established; and, consequently, in unit time molecules of CO_2 and H_2 are converted to CO and H_2O, while CO and H_2O molecules are converted into CO_2 and H_2. Therefore it must necessarily be concluded that below 1000°C. a determinable reaction takes place in the sense of $CO_2 + H_2 - > CO + HO_2$, which is in direct opposition to the researches of Naumann.

In all the tests which Lang mentions, the percentage of CO_2 increases, although not to the extent that theory requires on the supposition that $CO_2 + H_2 -> CO + H_2O$ does not take place; and it is not conceivable how Lang drew his conclusion from the tests recorded by him. Bearing in mind that Naumann's negative result is more conveniently and more certainly demonstrated than Lang's positive result, and that in Lang's tests difficulties had to be overcome which did not exist in Naumann's case, the latter's conclusion appears more reliable than Lang's. Meanwhile, it is desirable that the experiments of Naumann and Lang should be repeated. But until this has been done, a choice must be made between their results; and for the present purpose Naumann's will be taken.

If H_2O acts in this manner on CO, the fact is of great importance in the water-gas process. Granting that 6 per cent. of undecomposed steam is carried through the generator, and therefore into the water gas, then, after it leaves the bed of hot fuel, the water gas has, assuming a proportion of ± 2 per cent. CO_2, about the following composition, ignoring the percentage of H_2O or N_2:

2 per cent. CO_2, 47 per cent. CO, and 51 per cent. H_2.

This composition entails the use of 51 H_2O, which must be 94 per cent. of the total quantity used. So that, in all, there has been used 54·25 H_2O; and therefore 3·25 undecomposed H_2O is present in the gas. If this is now converted with CO into H_2 and CO_2, then the composition becomes:

5·25 CO_2, 43·75 CO, and 54·25 H_2; or, in percentages, 5·09 per cent. CO_2, 42·37 per cent. CO, and 52·54 per cent. H_2. Therefore the proportion of CO_2 has been increased 2½ times. What would happen if the gas contained 50 to 60 per cent. of undecomposed steam, and, moreover, under such conditions that the conversion in question could take place, can easily be seen. The calculation of the composition of that gas may be left to those who allow 50 to 60 per cent. of undecomposed steam in their gas, as they are directly interested in it.

The heat balance for the reaction $H_2O + CO - > CO_2 + H_2$, is as follows:

At 0°C. (if that were possible), it would give:

$H_2O + CO = H_2 + O + CO - 57{,}400 = H_2 + CO_2 - 57{,}400 + 67{,}968$, or $H_2O + CO = H_2 + CO_2 + 10{,}568$ cal. (21).

If the H_2O and CO be first heated to 1000° C., this requires:

For the H_2O : 1000 × 14·112 = 14,112 cal.
For the CO : 1000 × 6·86 = 6,860 „
In all 20,972 „

In order to heat CO_2 and H_2 to 1000° C., there is required:

For the CO_2 : 1000 × 19·021 = 19,021 cal.
For the H_2 : 1000 × 6·82 = 6,820 „
In all 25,841 „

The reaction at 1000° C. would therefore be:

$H_2O + CO = H_2 + CO_2 + 10568 + 20{,}972 - 25{,}841$,
or $H_2O + CO = H_2 + CO_2 + 5699$ cal. (22)

Heat is therefore liberated. It will, however, be easily understood that this heat will be either wholly or partly used to heat the steam which has passed through undecomposed, and has not at once attained the high temperature of the generator.

From what has been said, it will be seen that, if it is desired to keep the proportion of CO_2 in the water gas low,

1—An endeavour must be made to obtain the highest possible temperature in the generator.

2—One must try to have as little as possible undecomposed steam in the gas, not only because it carries off many calories, but also because it may cause the proportion of carbonic acid to rise considerably; and the heat thereby liberated is of no advantage to the generator.

It will be shown later how a high temperature can be obtained in the generator, and what means must be employed to render innocuous the proportion of undecomposed steam present. This will be returned to more conveniently later; and attention will first be given to the reduction of CO_2 by incandescent carbon.

(To be continued.)

Rival for Standard Oil.—The "Financial News" reports, on the authority of advices from Chicago, that an equitable division of stock is the only barrier which now stands in the way of the formation of a $20,000,000 oil trust, as a competitor to Standard oil. Interested in the deal is a Syndicate of Englishmen representing $10,000,000. The concerns to be taken into the new corporation, it is reported, include every oil company in the United States not at present under the control of the Standard Oil Company. The fields in which the corporation will operate, and in which, it is said, it has succeeded in gaining controlling interests, are in Pennsylvania, Ohio, Kentucky, Texas, and California.

EXPLOSIVE LIMITS OF COMBUSTIBLE GASES.

By Dr. P. EITNER, of Carlsruhe.

[Abstract Translation from the "Journal fur Gasbeleuchtung."]

SECTION II.—ALTERATION OF THE RANGE OF EXPLOSIBILITY BY DILUENT GASES.

The first section of these researches, of which an account has already been given in the "JOURNAL,"* referred only to experiments conducted with mixtures of the pure gases and pure atmospheric air. Such simple conditions of combustion frequently occur in practice; and in these cases the results obtained may be directly applied. Frequently, however, the conditions are more complex. The air which enters into the combustion is often altered in composition owing to combustion which has taken place previously. The proportion of oxygen in it has thereby been diminished; and it contains water vapour and carbonic acid. Its power of supporting combustion has been thus reduced; and this change finds its expression in a contraction of the range of explosiveness. Such modified conditions of combustion are found in the outer zone of gas-flames, and in the explosive mixtures in gas-engines. In the latter, some of the exhaust gases mix with the fresh charge, and so alter its composition in the manner indicated. These conditions should be distinguished from those in which the air is mixed in different ways with carbonic acid or aqueous vapour, as in other cases which occur—for instance, in lime burners, laundries, mines, &c., or in cases in which altered conditions are artificially induced in order to avoid danger of explosion or to extinguish a fire. Here the quenching action of the inert gases finds its expression in a contraction of the range of explosion or combustibility.

It is obvious that the explosion limits will be brought more closely together the more inert gas is mixed with the air which supports the combustion. The early observations of Bunsen showed that different inert gases behaved differently in respect of their quenching effect. But no observations have so far been made which determine their behaviour quantitatively; and the experimental data which would serve as a starting point for investigations in this direction are very few. The question, however, of the action of inert gases in explosive mixtures acquires greater practical importance as the use of so-called "poor" gases—such as blast-furnace gas—for actuating engines becomes extended. In order to obtain the necessary experimental groundwork for the due consideration of this question, the researches described in the sequel were undertaken. The experimental conditions were simplified as far as possible. Firstly, the effects of carbonic acid on the extent of the range of explosion was studied when carbonic acid replaced step by step the oxygen of the air; secondly, the effect of the same gas was studied, when it was added in increasing quantities to the air; thirdly, the alteration of the explosive limits produced by the admixture of water vapour to the gaseous mixture was investigated; and, fourthly, a series of experiments was made on the effect of the dilution of detonating gas with oxygen, nitrogen, or carbonic acid. The results in each case were finally plotted in diagrams.

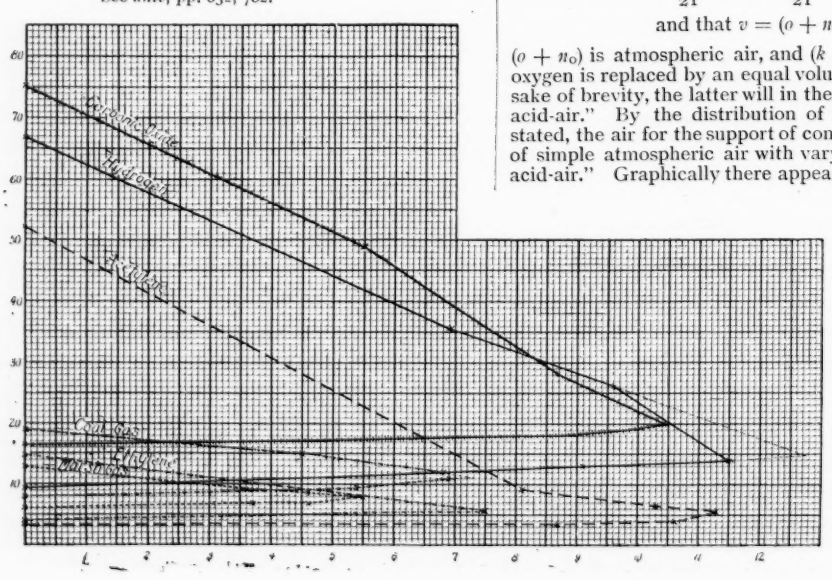
Part I.—Explosion of Mixtures of Combustible Gases with Air and Carbonic Acid.—The mixtures were stored over mercury in glass cylinders of a litre capacity; and their composition was checked by analysis before and after each series of experiments. The slight alteration of the limits of explosion due to the aqueous vapour present, which throughout amounted to about 2 per cent., was left out of account. The results obtained with the different mixtures, in which the atmospheric oxygen was replaced gradually by carbonic acid, are summarized in Table I., and are also shown graphically in the diagram at foot. This very clearly displays the way in which the contraction of the range of explosion increases as the proportion of carbonic acid in the air rises. It is noticeable that the boundary lines of the explosive field are approximately straight for all the gases except acetylene, the peculiar behaviour of which at different partial pressures would account for its divergence in this respect.

* See *ante*, pp. 632, 702.

TABLE I.

Mixtures of Air and Carbonic Acid (displacing Oxygen) with Combustible Gases.

Combustible Gas.	Percentage, in the Air-Carbonic Acid Mixture, of		Composition (Volumes per Cent.) of the Gaseous Mixture at the Lower Explosion Limit.				Composition (Volumes per Cent.) of the Gaseous Mixture at the Upper Explosion Limit.			
	Oxygen.	Carbonic Acid.	Combustible Gas.	Oxygen.	Carbonic Acid.	Nitrogen.	Combustible Gas.	Oxygen.	Carbonic Acid.	Nitrogen.
Hydrogen.	21·0	0·0	9·5	19·0	0·0	71·5	66·4	7·1	0·0	26·5
	10·5	10·5	12·7	9·2	9·2	68·9	35·7	6·8	6·8	51·7
	8·0	13·0	13·7	6·9	11·2	68·2	26·3	5·9	9·5	58·3
	7·0	14·0	Explosiveness has ceased.							
Carbonic Oxide.	21·0	0·0	16·5	17·5	0·0	66·0	75·1	5·2	0·0	19·7
	10·5	10·5	17·4	8·7	8·7	65·2	48·1	5·5	5·5	40·9
	9·0	12·0	18·5	7·3	9·8	64·4	28·4	6·4	8·6	56·6
	8·0	13·0	19·4	6·4	10·5	63·7	20·3	6·4	10·3	63·0
	7·0	14·0	Explosiveness has ceased.							
Marsh Gas.	21·0	0·0	6.2	19·7	0·0	74·1	13·0	18·3	0·0	68·7
	17·0	4·0	6·6	15·9	3·7	73·8	9·7	15·4	3·6	71·3
	16·0	5·0	7·1	14·9	4·6	73·4	8·7	14·6	4·6	72·1
	15·0	6·0	7·6	13·9	5·5	73·0	7·6	13·9	5·5	73·0
	14·0	7·0	Explosiveness has ceased.							
Ethylene.	21·0	0·0	4·1	20·1	0·0	75·8	14·7	17·9	0·0	67·4
	13·0	8·0	5·9	12·2	7·5	74·4	6·1	12·2	7·5	74·2
	12·0	9·0	Explosiveness has ceased.							
Coal Gas.	21·0	0·0	7·9	19·3	0·0	72·8	19·1	17·0	0·0	63·9
	15·7	5·3	9·4	14·2	4·8	71·6	15·3	13·3	4·5	66·9
	13·4	7·6	10·6	12·0	6·8	70·6	12·2	11·8	6·7	69·3
	12·8	8·2	Explosiveness has ceased.							
Acetylene.	21·0	0·0	3·4	20·3	0·0	76·3	52·2	10·0	0·0	37·8
	12·0	9·0	3·8	11·5	8·7	76·0	9·7	10·8	8·1	71·4
	10·0	11·0	3·8	9·6	10·6	76·0	6·6	9·3	10·3	73·8
	9·0	12·0	5·5	8·5	11·3	74·7	5·5	8·5	11·3	74·7
	8·0	13·0	Explosiveness has ceased.							



That the lines should be really straight would appear from the following considerations: The relations in these experiments seem at first sight to be somewhat complex, owing to the change in the proportion of carbonic acid in the mixture entailing a change in the proportions of the other constituents. Their consideration is, however, simplified if the nitrogen of the air is apportioned to the oxygen and carbonic acid in the proportions of these two gases. If a volume v of the air for the support of combustion contains o parts of oxygen, k parts of carbonic acid, and n parts of nitrogen, then $v = o + k + n$. But as the air in question results from ordinary atmospheric air by simple exchange of oxygen for an equal volume of carbonic acid, it follows that:

$$n = \frac{79}{21}(o + k) = \frac{79}{21}o + \frac{79}{21}k = n_o + n_k$$

and that $v = (o + n_o) + (k + n_k)$.

$(o + n_o)$ is atmospheric air, and $(k + n_k)$ is air in which all the oxygen is replaced by an equal volume of carbonic acid. For the sake of brevity, the latter will in the sequel be termed "carbonic-acid-air." By the distribution of the nitrogen in the manner stated, the air for the support of combustion appears as a mixture of simple atmospheric air with varying quantities of "carbonic-acid-air." Graphically there appears to be no change. It is only

necessary to multiply the percentage of carbonic acid on the abscissae axis by $\frac{100}{21}$, and a figure is obtained which represents the shifting of the limits as the proportion of "carbonic-acid-air" in the mixture rises.

On calculating the volumes of atmospheric air which are needed for the complete combustion of the combustible gas at the lower limit of explosion, and the volumes of combustible gas which might be burnt completely by the atmospheric air present in the mixture at the upper limit of explosion, there will be found the volumes of "air-detonating gas" contained in the explosive mixtures. Besides this "air-detonating gas," there remains in the mixture only a gaseous mixture, which consists: (1) At the lower limit of explosion, of the residue of atmospheric air and of "carbonic-acid-air;" or (2) at the upper limit of explosion, of the residue of the combustible gas and of "carbonic-acid-air."

The consideration of the question may be further simplified by supposing that this gaseous mixture does not participate in the combustion, but behaves wholly as a mixture of inert gases, which only dilutes the detonating gas in the explosive mixture. On assuming, then, that the law of Le Chatelier, quoted in the first section of this communication (*ante*, p. 703), is applicable in its most general form—according to which gaseous mixtures, which are at the limits of explosiveness, on admixture produce mixtures which likewise are at the limits of explosiveness, so that the admixture does not bring about new conditions of combustion—it follows for the cases under consideration that: Any volume of an inert gas requires a determined addition of detonating gas in order to become combustible; and this ratio of the volume of detonating gas required to the volume of the inert gas continues to hold also in the case of the mixture with another gaseous mixture which is similarly at the limit of explosiveness. But different inert gases require different additions of detonating gas in order to become combustible. For instance, "carbonic-acid-air" requires a considerably larger addition of detonating gas, in order to make the propagation of combustion possible, than does atmospheric air. To apply this law to the foregoing results, it is only necessary to regard the quantities of detonating gas in the mixtures at the limits of explosiveness as so apportioned to the inert gases in the mixtures that each thus constitutes a separate mixture at the limit of explosiveness. According to the law referred to, the quantity of detonating gas present is exactly sufficient for this purpose. This apportionment of the gases makes the gaseous mixture investigated appear as simply a mixture of two gaseous mixtures at their limits of explosiveness, of which one increases while the other decreases in amount with a rise in the proportion of carbonic acid present. Since this change of the ratio of the amounts evidently is directly proportional to the carbonic acid present, the consequential change in the proportion of detonating gas or combustible gas in the mixture is also proportional to the amount of carbonic acid. Hence the lines which delimit the field or range of explosiveness in the opposite diagram must perforce be straight lines.

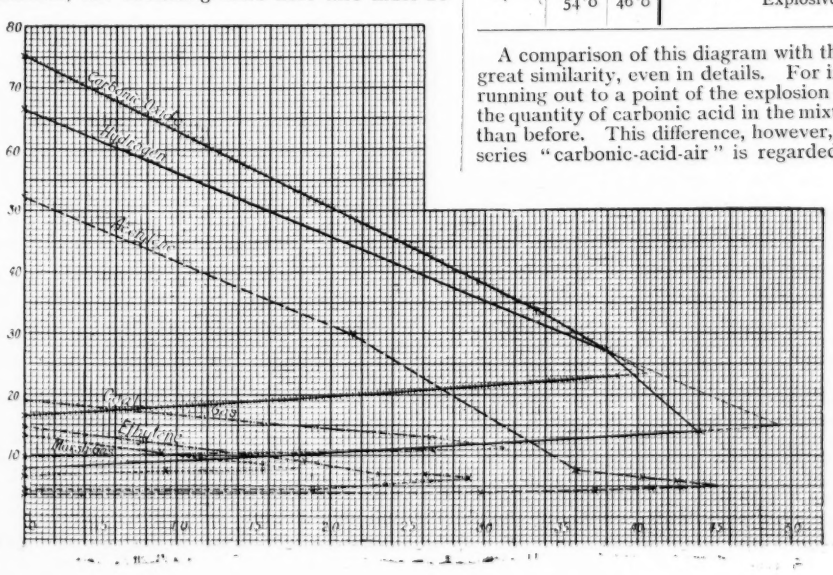
It is to be remarked, however, that the foregoing consideration presupposes that the other gases present in the explosive mixture in addition to the "air detonating gas" do not participate in the combustion, but behave as inert gases. This presumption is justified by the experiments so far as the lower limits of explosiveness are concerned; but only in the case of carbonic oxide for the upper limits. Hydrogen and all hydrocarbons behave differently. On the one hand, a part of the carbonic acid contained in the mixture enters into the combustion, and is reduced to carbonic oxide; while, on the other hand, considerably more of the combustible gas burns than corresponds to the theoretical detonating gas. But the combustion is incomplete—*i.e.*, products are formed containing, according to the conditions, different amounts of carbonic oxide, hydrogen, carbonic acid, and water vapour. Nevertheless, the delimiting lines here also must be straight lines, as the conditions of combustion change constantly in direct proportion to the increase in the carbonic acid present. Clearly these considerations apply only so long as all the constituents in question can be found in the mixture. But if, owing to the increase in the proportion of carbonic acid, one of the constituents—*e.g.*, at the lower limit, the surplus air—disappears, then the straight line receives a kink at this point, and its direction is altered. This fact is clearly exhibited in the diagram on the opposite page.

Just as it could be inferred, from the assumption that the aforementioned law of Le Chatelier applies generally in its general form, that the delimiting lines of the explosive field would be straight lines, so, conversely, the fact that the results of the experiments actually are in consonance with that inference can be claimed as proof of the general applicability of that law in the general form given to it. The experimental material, however, is not sufficient to substantiate this inference, as too few points of the delimiting lines have been determined in these researches, which were made for another purpose. The experiments subsequently described are simpler and easier to execute; and it is possible to consider them from similar standpoints.

Part II.—Explosions of Mixtures in which Carbonic Acid is Added by Degrees to the Air used, until Explosiveness Vanishes.—The results obtained with mixtures of the different combustible gases and air so admixed with carbonic acid are summarized in Table II. and are shown graphically in the diagram at the foot of this page. In all cases the gases were measured when saturated with aqueous vapour.

TABLE II.—*Mixtures of Air and Carbonic Acid (added) with Combustible Gases.*

Combustible Gas.	Percentage in the Air-Carbonic Acid. Mixture of		Composition (Volumes per Cent.) of the Gaseous Mixture at the							
			Lower Explosion Limit.				Upper Explosion Limit.			
	Air.	Carbonic Acid.	Combustible Gas.	Oxygen.	Nitrogen.	Carbonic Acid.	Combustible Gas.	Oxygen.	Nitrogen.	Carbonic Acid.
Hydrogen.	100·0	0·0	9·5	19·0	71·5	0·0	66·4	7·1	26·5	0·0
	49·0	51·0	13·7	8·9	33·4	44·0	26·4	7·6	28·5	37·5
	48·0	52·0	Explosiveness has ceased.							
Carbonic Oxide.	100·0	0·0	16·5	17·5	66·0	0·0	75·1	5·2	19·7	0·0
	50·0	50·0	22·6	8·1	30·6	38·7	33·8	7·0	26·1	33·1
	48·0	52·0	26·8	7·4	27·7	38·1	26·8	7·4	27·7	38·1
	47·0	53·0	Explosiveness has ceased.							
Marsh Gas.	100·0	0·0	6·2	19·7	74·1	0·0	13·0	18·3	68·7	0·0
	90·0	10·0	7·2	17·5	66·0	9·3	10·3	17·0	63·8	9·0
	83·0	17·0	7·7	16·1	60·5	15·7	8·6	16·2	60·0	15·5
	82·0	18·0	Explosiveness has ceased.							
Ethylene.	100·0	0·0	4·1	20·1	75·8	0·0	14·7	17·9	67·4	0·0
	80·0	20·0	4·4	16·1	60·4	19·1	9·0	15·3	57·5	18·2
	75·0	25·0	5·1	15·0	56·2	23·7	7·4	14·6	54·9	23·1
	72·0	28·0	5·6	14·3	53·7	26·4	7·0	14·1	52·9	26·0
	69·0	31·0	5·8	13·6	51·4	29·2	6·1	13·6	51·2	29·1
	68·0	32·0	Explosiveness has ceased.							
Coal Gas.	100·0	0·0	7·9	19·3	72·8	0·0	19·1	17·0	63·9	0·0
	70·0	30·0	10·9	13·1	49·3	26·7	12·3	12·9	48·5	26·3
	69·0	31·0	Explosiveness has ceased.							
Acetylene.	100·0	0·0	3·5	20·3	76·2	0·0	52·2	10·0	37·8	0·0
	70·0	30·0	3·9	14·1	53·2	28·8	28·9	10·5	39·3	21·3
	61·0	39·0	4·4	12·2	46·1	37·3	8·1	11·8	44·3	35·8
	57·0	43·0	4·8	11·4	42·9	40·9	6·8	11·2	41·9	40·1
	55·0	45·0	4·9	11·0	41·3	42·8	6·0	10·9	40·8	42·3
	54·0	46·0	Explosiveness has ceased.							



A comparison of this diagram with the preceding one reveals a great similarity, even in details. For instance, there is the same running out to a point of the explosion field of acetylene. Only the quantity of carbonic acid in the mixtures is very much greater than before. This difference, however, disappears if in the first series "carbonic-acid-air" is regarded as having been added,

instead of carbonic acid. The corresponding amount of "carbonic-acid-air" may be found by multiplying the figures for the carbonic acid in Table I. by $\frac{100}{21}$. The difference between the two series of researches, of which the results have been shown in Tables I. and II. and the corresponding diagrams, is only that in the first "carbonic-acid-air", and, in the second, pure carbonic acid, has been used to dilute the air for the support of combustion. As these two diluents behave similarly, the results found are alike; and in the second series also, it follows that the delimiting lines of the explosive field must be straight lines. The same argument in support of this contention applies as in the first series—merely with the substitution throughout of "carbonic acid" in place of "carbonic-acid-air."

(*To be continued.*)

GERMAN GAS ASSOCIATION MEETING AT DÜSSELDORF.

Programme of Arrangements.

The Annual Meeting of the German Association of Gas and Water Engineers will this year be held, as already briefly announced (*ante*., p. 888), at Düsseldorf from the 24th to the 28th of June. The proceedings will commence on the evening of the 24th with an assembly, at which those present will be entertained by the Municipality of Düsseldorf. The following morning will be devoted mainly to the reading and discussion of communications on gas matters; and in the afternoon there will be a steamer excursion on the Rhine to the town water-works. The morning of the 26th will be given up to the presentation and discussion of the reports of the numerous Technical Committees appointed by the Association; and in the evening there will be a dinner, followed by a concert. On the 27th, papers dealing with water supply will be read and discussed. Members will dine together at the Industrial Exhibition, where there will be a grand illumination in the evening. The exhibition will be again visited on the 28th, for which day technical excursions are also being arranged. A special programme has been prepared for ladies while the technical proceedings of the meeting are in progress. Owing to the great influx of visitors to Düsseldorf this summer, in consequence of the Industrial Exhibition which is being held there, early application for rooms is strongly recommended by the Committee of the Association.

In addition to the Inaugural Address of the President of the Association—Herr E. Beer, the Manager of the Berlin Water-Works—the technical communications to be made to the meeting comprise: "A Description of the Gas, Water, and Electricity Works of the Düsseldorf Corporation," by the Manager, Herr Grohmann; "An Account of the Coal Basin of the Ruhr District, with Special Reference to the Occurrence of Gas Coal," by Herr Grassmann, of Essen; "The Installation and Working of Inclined Retort Settings" (author's name not announced); "Coke-Ovens," by Herr Hilgenstock, of Dahlhausen; "Working Results of Electricity Works and the Prime Cost of Current," by Herr F. Ross, of Vienna; "Notes on Gas Purification," by Dr. H. Bunte, of Carlsruhe; and "Incandescent Gas Lighting and High-Power Burners," by Herr H. Drehschmidt, of Berlin. Communications dealing with water supply will also be read by Dr. Intze, of Aix-la-Chapelle, Herr Beer, of Berlin, and Heer Halbertsma, of the Hague.

The reports of the several Committees appointed to investigate the undermentioned questions will be presented by the respective Chairmen, whose names are appended: On "Photometry," Herr Thomas, of Zittau; on "Gas-Meters," Herr H. Söhren, of Bonn; on "Heating," Herr L. Körting, of Hanover; on "Standard Specifications for Gasholders," Herr M. Niemann, of Dessau; on "Water Statistics," Herr Joly, of Cologne; on "Water-Meters," Herr W. H. Lindley, of Frankfort-on-Maine; on "The Protection of Gas and Water Mains from Electrolysis," Herr W. H. Lindley; and on "Technical Instruction," Herr W. von Oechelhaeuser, of Dessau.

A new petroleum region has been discovered on the White Sea, in the north of Russia. The springs lie in the palæozoic rocks of Timan, along the River Oukhta, an effluent of the Ischma, in the two governments of Archangel and Wologda.

A recent number of the "Revue Scientifique" contains the following particulars of a process for the solidification of ammonia: Stearate of soda, dissolved at a temperature of 40° C., is added to the liquid ammonia in the proportion of 3 to 5 per cent.; and the proportion of ammoniacal gas may attain 33 per cent. Stearate of potash or other stearates can also be employed; but then the proportion of ammoniacal gas is only 10 to 20 per cent. The *modus operandi* is as follows: Three or four parts of stearate of soda are dissolved with 10 parts of ammonia at a slight temperature in a water-bath, and the mixture is then poured into 85 or 90 parts of ammonia, containing 30 per cent. of gas, heated to 40° C. During the operation, the mixture is kept constantly stirred. In a short time it hardens like jelly, and acquires the consistency of paraffin. If this jelly is subsequently left in the air, it gradually loses all the gas it contained—the more rapidly according to the height of the temperature.

OHIO GASLIGHT ASSOCIATION.

(*Concluded from p.* 1352.)

High-Pressure Distribution.

Mr. F. H. Shelton, of Philadelphia, sent a written communication on this subject, embodying some of the results of two years' experience. By the term high pressure, he understood an initial pressure of 10 to 30 lbs. per square inch. The great advantage as compared with the usual system, was that pipes one-third or one-fourth the size could be used. At Phœnixville, there was a run of 5½ miles of 3-inch pipe to Royersford and Spring City, enabling the whole district to be supplied from Phœnixville. A 6-mile run of 4-inch pipe had been adopted for a similar purpose at Rockaway Beach, New York; and a 5-inch line of similar length had been laid at Hackensach (N.J.). High-pressure pipe lines 8 miles in length had been adopted to re-inforce overtaxed mains in New Orleans. If £10,000 was required to build separate plants in small townships, the first cost might be an objection; and a high-pressure line from a gas-works a few miles distant would mean less than half the cost. The River Shore Gas Company supplied two neighbouring towns in this way; and the North Shore Gas Company supplied a scattered district through 12 miles of 4-inch pipe. The Philadelphia Suburban Gas Company supplied a dozen or more villages, scattered over an area of 8 by 3 miles, by means of 25 miles of pipe ranging from 6 to 1½ inches in diameter. In this case, individual regulators were used on each service. There were no gasholders; and a couple of £120 pumps kept up the supply. In each instance the result was satisfactory; and the cost could easily be figured out beforehand. The expense of pumping plant, mains, and regulators could be readily arrived at. The working costs might be taken at 1d. per 1000 cubic feet; so it was easy to see if such a system would pay in any particular case. The equipment worked as well as the rest of the gas-works plant; and there was no condensation, loss of quality, or other defects which had been freely prophesied. He strongly advised all having to reinforce existing mains, or studying the consolidation of small companies, to consider the question. With all the details properly designed and carried out, gas could be efficiently and economically handled at 20 lbs. pressure.

The President said that it was necessary to disregard Dr. Pole's formula, before one could put much faith in high-power distribution. According to that formula, it would be necessary to increase the pressure 1024 times in order to get a distributing effect equal to that of a pipe four times the diameter. The formula assumed that the delivery increased in proportion to the square root of the pressure, and that by increasing the diameter, the proportion of friction was reduced, and an increase in delivery obtained on that account equal to the square root of the fifth power. This formula had been accepted as correct for sixty years or more. According to it, if the delivery of a 1-inch pipe was equal to 1, that of a 2-inch was about 5¼, a 3-inch 16, and a 4-inch 32. Suppose the 1-inch pipe to be supplying at 17-10ths pressure, which was equivalent to 1 oz. per square inch, to increase the delivery 5¼, 16, or 32 times, there must be approximately 28, 250, or 1000 oz. pressure respectively. Altogether, he was not in favour of pressures exceeding (say) 5 lbs. per square inch. There must be a loss on compression above this limit; and it was only reasonable to expect a loss by rushing the gas at high velocities. Experience with compressed air showed the compression was attended with great waste in the form of loss of heat. The mechanical efficiency of the air compressing plant at Michigan was about 30 per cent.; and of the deficiency, 60 per cent. was thermal loss. He had hoped these points would be fully thrashed out. Mr. Littlehales was a thorough believer in the system, and said that if the thing had been done for three years, all the theories on earth could not alter it. In compressing Pintsch oil gas, there was a loss; but if there was a loss with coal gas, it was so slight as not to be perceptible to the eyes of practical gas men. He knew of a number of cases where the system could be advantageously applied in connection with long distance distribution. Mr. Shattuck said that at Darby they were supplying five towns on low and seven on high pressure; and while he did not recommend disturbing existing low-pressure mains, the high pressure was the thing for extension in scattered districts. He hoped to join up the systems of two works, and supply the whole from one. He could do a paying trade on 1½-inch high-pressure pipe with 25 to 30 consumers per mile; but a greater number would be required to make a low-pressure pipe pay. By adopting the best makes of pumping engines, the cost of compression could be brought to less than ½d. per 1000 cubic feet. In a commercial sense, there was no loss of quality through compression. He had made some rough experiments, and these gave an efficiency 25 per cent. greater than that shown by Dr. Pole's formula. He therefore thought the law was not accurate for high pressures. He had a compressor with valves actuated mechanically like Corliss valves, and a full cylinder at each stroke, and there was very little slip. Mr. Wile remarked that with compressing there was a gain in volume, while the friction did not increase in proportion. Mr. Moses was about to put down 40 miles of pipe to be worked at 20 to 30 lbs. pressure; and he expected to deliver 150,000 cubic feet per hour a distance of 38 miles through a 12-inch main. Mr. E. D. Johnson said that,

for pressures of less than 7½ lbs., the rotary exhauster was more efficient; but beyond that, the ordinary compressor had the advantage.

On the motion of Mr. Carpenter, a Committee of four was appointed to determine, by experiment, the laws governing the flow of gas at high pressures, or to indicate the lines on which reliable tests might be made. Mr. J. O. Johnston directed attention to the changed conditions of friction and velocity under high pressures, and believed that the engineers of some natural gas companies had investigated the subject. He was of opinion that increased pressure meant increased velocity without a corresponding increase of friction, and that the experiments would show higher results than those indicated by Dr. Pole's formula.

Full-Depth v. Half-Depth Benches.

Mr. D. R. Russell, of St. Louis (Mo.), submitted some notes on the question "Is there any Economy in Full-Depth over Half-Depth Benches?" He remarked that full-depth, half-depth, or free fires all had their particular spheres of usefulness. Recuperator furnaces were not of much use for a production of less than 15,000 cubic feet per diem; but with a maximum of 80,000 up to 250,000 cubic feet per day, he recommended half-depth, and over this quantity full-depth furnaces. For small works, he advised at least one bench of fours, but would use beds of sixes when size permitted, and in large works full-depth beds of eights or nines. He knew there was a prejudice against nines; but he considered it to be due to improper design, structure, or operating. The centre retort might give out before the rest; but it did yeoman work while it lasted. The average cost per 1000 cubic feet capacity, exclusive of foundations, but including ironwork and erection, was £6 12s. for half-depth sixes, £8 13s. 6d. for full-depth sixes, and £6 17s. 6d. for full-depth nines. The respective consumption of coke was 17½, 16½, and 13 lbs. per 100 lbs. of coal carbonized, or 27, 25, and 20 per cent. of the quantity made. Assuming an average output of 500,000 cubic feet per annum, a make of 13 cwt. of coke to the ton, selling price of coke 14s. 7d. per ton, and coal carbonized 18,500 tons per annum, the half-depth sixes would leave about £6388 worth of coke for sale, the full-depth sixes £6562, and the full-bench nines £7000—showing a saving of £174 per annum in favour of the full-depth sixes, and £438 more for the full-depth nines. The full-depth furnaces offered some convenience in working when the coal could be conveniently brought in on the stage-floor level, and also afforded facilities for adopting coke-conveying machinery, which could not easily be done with half-depth furnaces. He also claimed that full-depth furnaces would last out four settings of retorts, whereas it was scarcely safe to try them with half depths. He would not think of attempting anything larger than sixes with half depths.

Isolated Generator Firing.

A discussion on this subject was taken conjointly with the previous paper. Mr. W. E. Steinwedell, of Belleville (Ill.), claimed, on their behalf, an economy in labour, and greater facility for adjusting heats than was possible with individual generators; also considerable saving in respect to wear and tear of retorts. The President thought this scarcely did full justice to the advantages of isolated generators. One great advantage was that breeze and other cheap fuel could be utilized to an extent that was not practicable with the individual generator; and it was also possible to utilize the tar and ammonia from the furnace gases. While the first cost of adapting the isolated generators to existing settings might be more, it would certainly be less in the case of new work, and, in addition to the saving of labour, there was the economy in regard to the disposal of the fuel and removal of ashes, which could be dealt with to a greater advantage in the case of one large furnace than of several small ones. That a much longer life for the retorts might be looked for had been demonstrated in practice at Columbus, Ohio; and he believed that it would be possible to condense, wash, purify, and store the producer gas, and yet show results that would compare favourably with the present processes. Against the possible greater loss by radiation, &c., it should be remembered that, while in the present process regeneration must for practical reasons be limited to the secondary air—that is, to half the present air supply—no such limitation obtained in the case of the isolated generator. He proceeded to consider the question fully, comparing the actual heat gains and losses, and showed that in the ordinary generator 73 per cent. of the heat was utilized, while in the isolated generator as much as 84 per cent. might be obtained in ordinary practice. Mr. Dell thought that the advantage of the half-depth furnace as compared with free firing was generally acknowledged, and also that of recuperation. He thought, too, that the value of full-depth over half-depth was equally well known. The objection to the pit in front of the setting might be met by having the furnace and clinkering doors at the back; and this applied to full as well as to half-depth furnaces. It was not always convenient to have a stage floor; and a solid, unimpeded floor in front of the retorts was a great desideratum. Mr. Miller was about to erect a new retort-house at Cincinnati, and designed full-depth benches of eights and nines. He considered them more efficient than half depths; and for local reasons it was desirable to keep the working floor of the retort-house 15 feet above the ground level. A bed of sixes could be operated as economically in respect to fuel as larger beds. Mr. Russell asked whether Mr. Doherty preferred to use the gases from the isolated generator while fresh and hot, or to store them in a holder, which would involve cooling and re-heating. Mr. Doherty said that under present construction, there was more waste heat than they could possibly use, and therefore no occasion to save the sensible heat of producer gas. So he advocated cooling and storage, which rendered him independent of temporary variations in the working of the generator. He advocated producer gas for heating retorts five years ago, but it was generally opposed, and, so far as he knew, had never been adopted in gas-works, though he believed the New England Gas and Coke Company applied it to their coke-ovens, and it was successfully applied to other kinds of furnaces. The present form of gas-works furnace was the worst possible, as regarded good results. The ideal condition was maximum area and minimum wall surface; and this was just reversed by the long, narrow furnace generally used. The fuel at present cost anywhere between 10d. and 5s. 6d. per ton of coal carbonized; and there was room for great saving. In comparing different sized benches, it was scarcely fair to take the cost of the bench alone. The whole cost, including land, retort-house, &c., should also be included to get a fair comparison. Dr. Schniewind thought that anyone acquainted with the operation of steel-works and blast furnaces must be surprised that gas-engineers were so far behind. An impression appeared to exist that the primary air must not be heated, because it might prevent the solidification and removal of the clinker. But this condition need not be observed. In many forms of generator, the clinker was run off in a liquid state; and by carrying recuperation to a further degree than was usual in gas-works, a higher temperature was obtained in the generator, and a better quality of gas produced. Mr. Young had used producer gas for coke-ovens, and said that one argument in support of Mr. Doherty's scheme was the increased yield of ammonia. In certain localities, and with some kinds of coal, as much as 80 to 100 lbs. of sulphate per ton could be recovered; and the fuel would cost absolutely nothing. With the isolated producer, it was possible to make a uniform quality of gas; and the dampers could be so regulated that the wear and tear of the retorts would be reduced to a minimum. Mr. Doherty pointed out that his remarks on heating the primary air referred only to the usual pattern of furnace.

Iron or Lead for Meter Connections.

Mr. W. A. Baehr, of Denver (Col.), started the subject of "Can Iron Meter Connections be Used to Better Advantage than Lead?" by taking the affirmative. While the cost was practically the same, he claimed that iron connections were stronger, less liable to breakage or fracture, safer in case of fire, would not flatten or kink, afforded more obstruction to dishonesty, could be more readily thawed out, required less head room under low shop boards, &c., and were indestructible by rats. But they required a better class of fitters; and it was necessary to send out a greater weight of fittings. Mr. Eysenbach said that at Columbus, the Natural Gas Company had put down 15,000 meters all with iron connections; and they proved so satisfactory that he would prefer them to lead, even if more costly. Mr. Franklin exhibited specimens of his patent meter joint, of which 15,000 had been fixed at Cincinnati, and for which he claimed superiority both as regards lead and iron. It was perfectly pliable, put no strain on the meter, could not flatten or kink, but left a free passage at all times, could be easily fixed and disconnected any number of times without damage, and could be locked at each end by means of a punch and lead seal. The President spoke in favour of iron connections, which he had largely adopted as being cheaper, as well as better than lead.

Gas Water-Heaters.

Mr. W. B. Calkins, of Denver, described some tests of domestic water-heaters, using gas for fuel, and placed in connection with the ordinary kitchen boiler. The method was to allow water to flow through the apparatus until the temperature at the outlet became constant, and then to allow 5 gallons of water to pass, and to note the quantity of gas consumed during the operation. Taking the efficiency of the gas at 540 B.T.U., five tests of different apparatus showed efficiencies of 66, 51, 73, 66, and 58 per cent. respectively; the water being raised to 110°, 102°, 112°, 118°, and 124°. He remarked that the lower the temperature of the water required the greater the efficiency, and that much higher values could be shown by passing water more rapidly. Therefore, when the heater was used in connection with a hot-water storage cistern, it was important the connections should be so arranged as to promote circulation. The base of the heater should be on a level with, or a little below, the base of the cistern, and the hot-water connection should pass from the heater to the top of the cistern, and not the side. Mr. Stone thought the results shown were low, as he had been able, with a 650 B.T.U. gas, to get 70 to 75 per cent. efficiency. This arrangement was all very well when gas was used as an auxiliary to the kitchen fire; but if gas alone was depended on, he thought the instantaneous water-heater was more economical. He knew of an appliance of this kind that would deliver water at 130° and give 90 per cent. efficiency; and this was to be expected, because in the instantaneous form of apparatus there was no store tank to keep hot, and very little loss by radiation. Mr. Malone said that loss by radiation could be lessened by lagging the boiler and cistern, which could be done at a small cost. He found he could protect a boiler in this way at a cost of about 8s., and so efficiently

that the water remained warm many hours after the gas was turned off. The President said that the efficiency of the instantaneous heater would vary with the flow of water through it. The more rapid the flow, the better the result, but the lower the temperature; so the efficiency really turned on the temperature of water required.

Recent Developments in Inclined Retorts.

Mr. F. Egner, of Morristown (N.J.), submitted a communication on this subject. The paper, together with an abstract of a supplementary one by Mr. A. H. Barrett, was given in the "Journal" for April 15, p. 958.

The Wrinkle Department.

Mr. E. E. Eysenbach, the Editor of the Wrinkle Department, presented his report. For dissolving the scale on a gas-engine cylinder, the application of commercial muriatic acid was recommended. A resistance meter consisted of a diaphragm with openings of known area inserted in a gas-main. Pipes from either side of the diaphragm were connected to a U gauge, and the extent of resistance as indicated by the gauge showed the quantity of gas as calculated from the known area of the openings and the known pressure. A table could be calculated out showing the quantity corresponding to each tenth as indicated by the gauge. The use of air under pressure for cleaning retorts could be successfully and easily managed by laying on a system of pipes from the outlet of the water-gas blower, using flexible metallic tube and an injector, as was done with steam. Another wrinkle was a purifier-box built of cement instead of iron, with a luted cover in place of the usual water seal. For assisting the condensers during the hot summer weather, water was allowed to trickle down, and evaporation accelerated by means of an air blast created by a 36-inch fan. A coke-screening arrangement consisted of a set of three screens set at an angle of 30°, one above the other, and actuated by shaking machinery. The first was 2-inch mesh, the second 1-inch, and the third ½-inch. The screens were moved or vibrated 160 times per minute by a shaft, crank and system of spur gearing, and so arranged as to turn off their contents in opposite directions. Punched metal screens were much more durable than bars or wire. An arrangement for heating lengths of wrought-iron pipe for coating with tar, consisted of a frame with standards carrying pipes with conical ends. One set was fixed, the other on a travelling carriage. A length of pipe was gripped between the cones, one at each end, and steam admitted from a flexible tube connection. A wrinkle for regulating the supply of liquid to scrubbers consisted of a small tumbling box, which discharged its contents into a second box mounted on a long lever with counterpoise, the axle of which was the spindle of a valve on the rising pipe. The contents of the second box escaped through an adjustable outlet, and the effect of the tumbler emptying into it was to cause the box to fall, partly rotating the lever, and opening the valve. As the contents escaped, the counterpoise gradually restored the box to its former position, and closed the valve. By regulating the supply to the tumbler, the number of flushes per hour could be varied; and by altering the time required to empty the balanced box, the duration of each flush could be controlled.

The Question Box.

The Question-Box contained several interesting inquiries. One of them was as to the most satisfactory method of recording a large consumption—say, 2000 to 6000 cubic feet per hour; and Mr. M'Ilhenny said it was better to use a battery of three or more meters rather than one large one; as, in the event of the account being closed, it would be easier to utilize them for other consumers. "What Success are Gas Companies having with Gas Arc Lamps?" brought out the information that Mr. Andrews had put out 200 at a small rent and maintenance charge. The average consumption was 2000 cubic feet per lamp per month; and he regarded it as a good investment. Mr. Franklin supplied 1600 lamps on twelve months' trial, and had perhaps 50 returned. The terms for those that were kept were purchase by twelve monthly instalments. Mr. Lathrop remarked that the Chicago Gas Company had placed 10,000 Humphrey arc lamps; and at Minneapolis the Gas Company had put in 1200 lamps. Mr. Neeley strongly recommended letting out arc lamps on low maintenance terms, or even giving them away. Mr. Mulholland said that the best way to introduce gas arc lamps was to put them out on a month's free trial. He had placed 150 on these terms, and not had one returned. He either sold the lamp outright at a small profit, or charged a rent of 3s. per month, which included maintenance and cleaning globes. If the lamp was purchased, he undertook maintenance at the bare cost of materials used. Mr. Franklin said that at Cincinnati they put out 1600 on a year's free trial, including maintenance. In sending in the bills, only 55 were returned. They now supplied them on hire-purchase terms—twelve monthly payments of 4s. 2d. each.

In reply to an inquiry as to whether a consumer supplied with gas at 40-10ths pressure really got more value than if supplied at 20-10ths, Mr. Dunbar thought the higher pressure was a decided advantage in the case of Welsbach and atmospheric burners. On the comparative value of gas and gasoline in a gas-engine, the President said that 1 gallon of gasoline was equivalent to 230 cubic feet of gas. Some discussion took place as to the best kind of floor for coal-sheds; and tar pavement was given the first place, concrete being second.

The Specific Gravity Committee presented a brief report, in which they stated that the specific gravity of coal gas ranged between ·420 and ·450; coke-oven gas, ·520 to ·550; water gas, ·600 to ·680; and natural gas, ·550 to ·600.

CAST AND WROUGHT IRON GAS-MAINS.

It may be remembered that, in the course of the proceedings at the recent meeting of the Ohio Gaslight Association, Mr. John Franklin, of Cincinnati, read a paper on the subject of the extension of gas-mains (see *ante*, p. 1351). In the discussion to which it gave rise, some remarks were made on the relative advantages of cast and wrought iron pipes for gas-supply purposes; and these elicited the following article by Mr. Godfrey L. Cabot, of Boston (Mass.) in the "American Gaslight Journal."

Three years ago, I visited nearly every country in Europe, excepting Spain and Greece, studying this question; also New York, Philadelphia, and Pittsburgh. In every system of cast-iron mains that was investigated, the leakage was incomparably greater than in our own wrought-iron mains, which have a total length of from 60 to 70 miles, and convey from 9 to 10 million cubic feet per day. After due allowance for the fact that the conditions are very favourable in the different places to which our mains extend, as compared with any one of the municipal plants visited, the weight of the evidence still remains very greatly in favour of wrought iron. In the first place, wrought iron itself is impervious to gas; cast iron is not. I have seen cast-iron fittings bubbling where the gas came through them; and whenever a cast-iron main is raised, after artificial gas has been passed through it for a considerable time, the surrounding soil smells strongly of gas.

Cast-iron mains are usually put together with lead, and a lead joint does not work well. Any displacement of the pipe, or the mere effect of time, with the variations of temperature which are constantly taking place, and which affect differently two metals having a different co-efficient of expansion, will loosen the joints. Various rubber joints are in use in different parts of Europe. But, cast iron having a rough surface, and the process of manufacture not permitting of the same exactness in dimensions as wrought iron, it is impossible to sufficiently protect the rubber bands which form the joints from the oxidizing effect of the air, which is present in most soils; and in any considerable length of main put together with any of the various forms of rubber joints in use in Europe, some portion will become leaky before many years are past.

Some time ago there was a terrible subway explosion in Boston, which would not have occurred if the mains had been made of wrought iron. The evidence showed that the mains had cracked, and wrought iron will not crack, whereas cast iron frequently does so, where subsidence takes place or a very heavy team goes over it.

Wrought iron is said not to withstand the action of the soil so well as cast iron; but I think this is fallacious. It is true that, in a given time, a larger proportion of wrought-iron pipe will become oxidized under given conditions than cast-iron pipe; but the oxidization of the former takes place evenly over its whole surface, while the latter becomes pitted, and rusts through in one place.

It is true that wrought-iron service-pipes, unprotected, do not last so long as the cast-iron mains to which they are connected. But they are not nearly so favourably situated—first, because they approach nearer to the surface of the ground; secondly, because they are exposed, at the kerbstone and at the house wall, to exceptionally unfavourable conditions. Where service-pipes are swathed with a double thickness of cloth, soaked in soft coal tar pitch, there seems to be no limit to their life.

At the time the subway was being laid in Boston, there was hardly a point for over half a mile at which one could not smell gas when walking along the street; and our system of gas piping in Boston is one of the most perfect for cast-iron pipe. We know of no other where there is a smaller percentage of gas unaccounted for; and we have made very particular inquiry in a great many different cities. This certainly shows that the present system is susceptible of improvement.

The relative first cost of the two kinds of mains varies in different localities. A few years ago, wrought iron was decidedly cheaper in proportion to the size of the main; and it will probably be so again as soon as the competition with the present very powerful combination of tube manufacturers has had time to develop.

I am in favour of laying gas-mains entirely of wrought iron, using as far as possible malleable fittings, and insisting on a good quality of cast iron for such fittings as cannot be bought of malleable iron. Secondly, every part of the system, for mains laid under paved streets or in bad ground, should be swathed in a double thickness of cloth soaked in coal tar pitch. You will then have a system that will be the most durable and the tightest that technology has yet discovered practicable for this purpose; and the saving in leakage and in expense of repairs will in most cases pay for the additional first cost, which may be roughly considered to be the labour in applying the protective covering.

I would not have it understood by any means that I am advocating the tearing up of cast-iron mains that are in fair working condition in order to replace them with wrought-iron ones; but where extensions are made, or cast-iron mains must be replaced, we advocate the substitution of wrought iron. We have not, as

yet, had to replace any of our wrought-iron mains, although some of them are nearly twenty years old.

There is no great difficulty in using cast and wrought iron mains together; and in connecting the latter to the former no especial appliance has, generally speaking, to be used that cannot be bought in the open market.

I think that, in good clay soil in unpaved streets, it will not generally be needful to apply any special protection; but where streets are paved, or there is an exceptional expense for digging them up, where the soil is loose, wherever a gas-main passes through or near a sewer or a bed of cinders, or is exposed to water from some coal seam, it is better to protect it in the way described. I have seen a thin sheet-iron pipe that had been in the ground for sixty years, protected by a mixture of coal-tar pitch and gravel; I may also add, by a thin layer of lead, which, however, has very little effect. The pipe was just as fresh as the day it was put down. The weakness, however, of that particular system lay in the fact that the covering of gravel and tar was easily cracked, and wherever water entered it quickly destroyed the pipe. It is chiefly of interest to us as showing that where pipe is protected by tar there is no known limit to its life. The mummies of Egypt are irrefutable evidence of the efficacy of this method of excluding air and water, for the bitumen in which the mummy cloths were dipped is precisely analogous in its effect to the much cheaper material which we propose.

There is one danger, however, from which, to the best of my knowledge and belief, this is not a defence—namely, that of electrolysis. Where any considerable amount of electric current gets into a system of underground pipes, there is no cure for this disease; the only thing is prevention. We know of no metal, save only the noble ones, that will not be corroded in moist earth with the electric current; and where considerable current gets into the pipe, it may melt off any protective covering that you can put on it. So, again, we think wrought iron is at least as safe as the cast-iron pipe, for it at least gives a continuous conductor. The corrosion does not take place when the electricity enters the pipe, but where it leaves it; and with the wrought-iron pipe you can, at favourable places, lead off a portion at least of your electricity by a chain into a stream of water, and corrode your chain or piece of old junk instead of your valuable pipe. But in the case of cast-iron pipe, a portion of your electricity is likely to leave the pipe at any joint; and there the pipe will be pitted.

Mr. Livesey's Gasholder Diagram.—Mr. George Livesey writes to say there are one or two mistakes in the figures on the skeleton diagram of large gasholders published in the "JOURNAL" for the 13th inst. (p. 1277); and he suggests that possibly the introduction of other gasholders not in the series may be the cause of a little confusion. The chief modifications required are the substitution of the year 1866, in place of 1880, as the date of Mr. Thomas N. Kirkham's Imperial Company's two-lift holder at Fulham, and of 1,400,000 cubic feet, instead of 1,250,000 cubic feet, as the capacity of Mr. William Innis's Phœnix Company's two-lift holder at Kennington. With regard to the latter holder, the figures were given on the authority of "King's Treatise;" but Mr. Livesey points out that the larger capacity is correct.

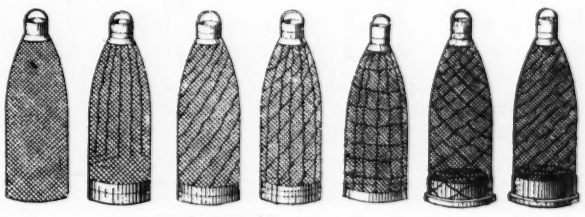
Coal-Cutting by Machinery.—In the course of a speech recently delivered in the House of Commons by Mr. Ritchie, the Home Secretary, he complained that mineowners in this country do not make use of coal-cutting machinery to anything like the extent that is done in the United States. If this arises from want of knowledge of the various appliances available, that want can now be supplied by a book just published by the "Colliery Guardian" Company, Limited, under the above title. It is No. 15 of a series of handbooks, and its author is Mr. Sydney F. Walker, Assoc. M.Inst.C.E. The work is a reprint of a series of articles which appeared in the "Guardian" between January and June last year, which were the result of special investigations undertaken by the proprietors of that publication into the question of the application of coal-cutting machinery in British mines. The volume will be followed at an early date by a companion one on "Coal-Cutting by Machinery in America," which will contain the results of similar investigations carried out by a special commissioner sent to the United States for the purpose.

Austria-Hungary Gas Association.—The general meeting of the Association of Gas and Water Engineers of Austria-Hungary takes place, as already announced (*ante*, p. 1015), at Vienna to-day (May 27) and to-morrow. The usual private business is to be transacted, and the following technical communications read and discussed: "Obstruction of Water-Pipes, Etc., by Tree Roots, Etc., and the Remedies," by Herr G. Koss, of Eger; "Pressure Regulators," by Herr Blum, of Berlin; "Lighting Devices for Incandescent Gas Street-Lamps," by Herr Bernauer, of Budapest; "Improvements in Automatic Gas Analysis, and a Sensitive Dry Pressure-Gauge," by Dr. H. Strache, of Vienna; "Novelties in the Application of Gas to Cooking and Heating," by Herr G. Wobbe, the Manager of the Vienna Municipal Gas-Works; "Furnace Construction," by Herr Horn, of Bremen; and "Heating Appliances," by Herr Zelle, of Vienna. A lecture (the subject of which has not been announced) will be delivered by Captain Walter, Professor at the Military Academy at Vienna. A good programme of festivities and excursions has also been arranged for the meeting, which is under the presidency of Herr Wobbe.

REGISTER OF PATENTS.

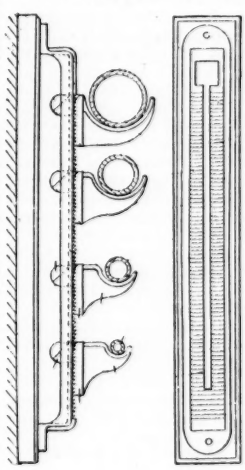
Mantles for Incandescent Gas Lighting.—Missire, F. & M. L., of Paris, No. 9460; May 7, 1901.

The object of this invention is to render incandescent mantles more durable, and better able to withstand vibration or other shocks, than mantles made as heretofore; the mantles being also adapted to be placed directly on the burner. It consists in "making a mantle in about the usual manner, but which, when incinerated, will have a series of ribs or equivalents projecting, either internally or externally or in both directions, whereby the fabric is strengthened considerably."



Various forms of the mantle are shown. By one method, the patentees prepare an ordinary mantle, and before treating it chemically, interlace extra or additional strands or strips of cotton or other suitable material with the meshes of cotton or other fibrous material of which the mantle is made. They next treat the mantle in any usual manner, by impregnating it with a solution of metallic salts, and, after drying, incinerate it. The additional strands will thus have ribs or equivalents of the oxide formed on or in the mantle. These extra strips may be arranged in any way, and be of any width. The base and head of the mantle are similarly strengthened; but for this purpose strands or strips of considerable width, of any suitable incombustible material—such, for example, as mineral flax—are applied in any practical manner, either by winding them around the edge of the mantle, or by interlacing them with the fabric of the mantle, or by folding or doubling a strip of the material around the edge of the mantle or otherwise.

Support for Pipes, Mains, &c.—Longsdon, H. C., of Keighley. No. 10,134; May 16, 1901.



These means whereby a line of pipes, mains, or the like may be carried along the side of a wall or crosswise of a series of pillars when it is desirable to sustain some above the floor or ground, consist in so constructing the supports that their height may be readily adjusted to meet the varied conditions as to irregularity in thicknesses or diameters of the pipes or otherwise, by forming a base-piece (secured to the wall or pillar by which the line of pipes has to be supported) slotted to receive a projection from the arm upon which the pipe has to be placed. The extending end of this projection is such that (as shown), it will enter the enlarged opening at the upper end of the slot in the base-piece, but will not pass through it at its lower part; while on the outer face of the base-piece, and on that of the arm which is in contact with it, a series of teeth are formed so that the weight of the arm and the parts it supports may be sustained in any position lengthwise of the base-piece.

Chimneys for Gas-Works.—Cripps, F. S., of King William Street, E.C. No. 11,024; May 29, 1901.

The patentee proposes the construction of sheet-iron or steel chimneys with an inner and outer cylinder, the annular space between the cylinders being filled with a non-conducting material—such as slag wool—for the purpose of preventing or reducing the radiation of heat from the chimney, and the consequent cooling of the hot gases, and so as to admit of using a shorter chimney than is usually adopted without impairing the draught. These chimneys are, he remarks, more particularly intended for use in connection with retort-benches in gas-works, where a separate chimney is provided for each "setting" of retorts, and it is desired to shorten the chimney for the sake of appearance or otherwise, and also to reduce the weight on the retort-bench.

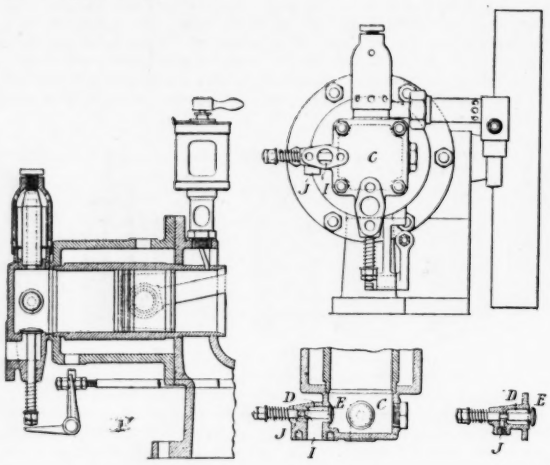
Gas-Engines.—Graham, H. B., of Birmingham. No. 4011; Feb. 17, 1902.

In this gas engine, combined with the ignition-chamber is a mixing-chamber having an air-inlet, and communicating with the ignition-chamber by a valve normally closed by a spring, the stem of which is provided with a groove, recess, or slot, in the portion within the bearing carrying it, so as to form a chamber into which the gas-inlet opens.

As shown (p. 1424), the communication between the chamber D and the ignition-chamber C is normally closed by a valve E, the stem of which extends through a bearing formed in the wall of the mixing-chamber, and is provided on the projecting portion with a spring,

which bears at one end against the outside of the wall of the chamber D, and at the other end against a stop-nut upon the extreme end of the stem, thereby normally holding the valve upon its seat.

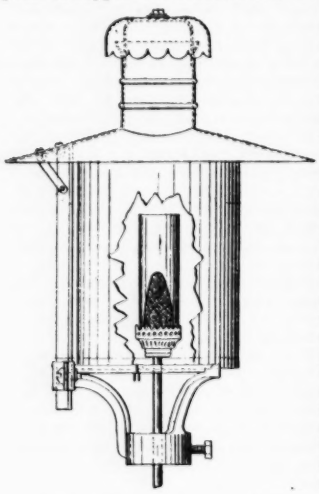
I is the air-inlet which opens directly into the mixing-chamber, and J is the gas-inlet which opens into the stem-bearing in the chamber D—the valve-stem at this part being formed with a groove or recess (or a slot may be formed through the stem), so as to form a chamber into which the gas-inlet opens.



With this arrangement, on the suction stroke of the piston the valve is withdrawn from its seat—thus drawing in air through the inlet I and bringing the gas inlet J into communication with the chamber D, so that gas is also drawn into the chamber in which the gas and air are mixed, being then drawn into the ignition chamber C, where the mixture is exploded and expands to operate the piston in the usual manner. On the compression stroke of the piston, the valve E is closed—thus cutting off the admission to the ignition-chamber, and also the entrance of gas to the mixing-chamber, by again closing the gas-inlet J.

Lantern Apparatus for Gas and Other Lighting.—Marriage, T. S., of Reigate. No. 11,210; May 31, 1901.

This invention relating to lanterns for use in lighting by gas, proposes to support the reflector and ventilating hood, when made in one built-up piece, from a T-iron or other support from the frog or cradle on the lamp-post; the reflector having connected to it (as shown) a plate carrying lugs in pairs, and having a hole in each in line one with its opposite neighbour. One pair of lugs receives between its members the end of the T-iron; and a bolt passing through all three forms the connection, which also constitutes a hinge upon which the reflector can be turned to facilitate access for cleansing. The T-iron below the reflector and glass lantern is attached to one arm of the frog or cradle by a cap or clamp connected to a portion of the frog arm, so that when the screws are tightened up, the T-iron is held firmly in its adjusted position; while, when loosened, the T-iron can be raised, lowered (to adjust the reflector or cover to the glass), or removed, as desired.



Gas-Engines—Dudgeon, A. J.; a communication from the Société Anonyme John Cockerill, and Savage, H., of Seraing, Belgium. No. 4130; Feb. 18, 1902.

This invention relating to gas or other explosion engines, has for its chief object to provide efficient means of governing same, and to regulate the supply of air and gas thereto. The invention is particularly adapted to the case of gas-engines employed in driving dynamos, which require a high co-efficient of regularity.

Many attempts have been made, the patentees remark, to improve the regulation of gas-engines, and to avoid the shocks which attend working with the hit-and-miss governing commonly employed. Two methods with this object in view have in particular been proposed. The first acts upon the richness of the gaseous mixture, by varying the proportion of gas admitted for the charge. The principal drawback of this method is that it only allows the proportion of gas to be varied within very narrow limits, and that it gives less readily ignitable explosion mixtures. The second method is to vary the volume of the explosive mixture admitted to the cylinder, maintaining a constant proportion of gas in this mixture—viz., that most suitable for perfect ignition. This method, however, is only applicable in practice to engines of medium power.

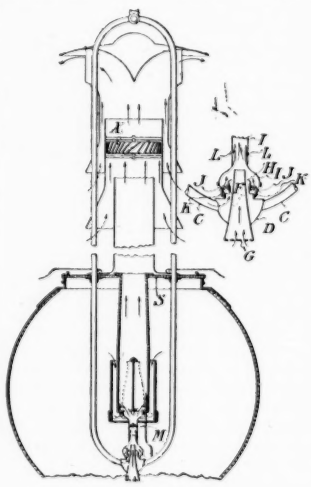
One of the chief disadvantages which is encountered in the construction and employment of gas-engines of great power is the considerable tension which it is necessary to give to the springs of the gas admission and exhaust valves. This tension is necessary in order to prevent the possibility of the valves rising on their seats when, in consequence of a misfire, the air-pipe has to alone furnish the charge to the cylinder during the admission stroke. The depression produced from this cause in the cylinder tends to cause the gas admission and exhaust valves to move off their seats, and allow the products of combustion to re-enter the cylinder. The tension of the springs should be sufficiently great to resist this depression. Now the pinions, the secondary shaft, and the cams have to overcome the tension of these springs, besides the considerable force which has also to be exerted by the exhaust valve by reason of the pressure existing in the cylinder at the moment of opening the exhaust. Moreover, the reactions in this movement are very great. In the case of large engines, in particular, as a much greater depression must exist in the cylinder with early cut-offs, when the engine is only developing small power, it would be necessary, in order to retain the valves on their seats, to employ springs of such power that the working would be rendered exceedingly hard and violent.

It is the object of the present invention to overcome these several drawbacks, and to provide governing mechanism for gas and other explosion engines which will "ensure a regulation of the utmost sensitiveness of the quantity of explosive mixture admitted to the cylinder."

After a lengthy detailed description of the construction of the valves, governors, &c., employed (accompanied by four sheets of drawings), the patentees claim as their invention: 1. The combination with simultaneously opening air and gas admission valves of a cam adapted to be rocked, for opening and closing the valves; a driving pawl or catch adapted to engage the cam and impart motion in one direction thereto to open the valves; means for effecting the disengagement of the pawl or catch from the cam; means for varying the moment of such disengagement under the action of a governor; and means for imparting motion to the cam in the opposite direction to close the valves and to bring it back to its normal position for re-engagement with the pawl. 2. Means for varying the moment of disengagement of the pawl or catch from the operating cam of the air and gas admission valve—comprising a governor of the air-pump type, having a main piston and a subsidiary piston operated by air compressed between the pistons, and an adjustable leak-off cock provided for the compressed air; a governing cam; and a set of levers for transmitting the motion of the subsidiary piston to the governing cam in such manner as to shift the position of the governing cam in accordance with the movement of the governor. 3. Means for varying the moment of disengagement of the pawl or catch from the cam of an air and gas admission valve—comprising a centrifugal governor, and means for transmitting the motion of the governor to the governing cam in such manner as to shift the position of the governing cam under the action of the governor to effect the disengagement of the pawl or catch in accordance therewith.

Incandescence Gas-Lamps.—Duffek, A., Wein, H., and Beschorner, A., of Vienna. No. 4151; Feb. 18, 1902.

This invention relates to incandescence gas-lamps in which intimate mixture of the air supply with the gas supply is effected, while the air supply is subjected to preliminary heating. A vertical section of the lamp and an enlarged vertical section of the mixing-tube, with its gas and air nozzle, are given.



The gas supply-pipe branches into two vertical tubes, one of which opens at the lower end into the nozzle-chamber D at the lowest part of the burner, while the other communicates with the igniting-tube E. Centrally in the nozzle-chamber is a conical nozzle F, which has at its lower end a rotatable slide G for regulating the inlet of air. The conical nozzle F forms together with the annular cap H screwed on to the upper end of the nozzle chamber, an annular nozzle through which the gas rises, and thereby draws in air through the nozzle F.

To the upper part of the nozzle-chamber is screwed the mixing-tube I, provided at its lower end with air-inlet openings J, whose sectional area can be regulated by means of a slide K. The upper part of the mixing-tube is cylindrical, and is provided with air-inlet holes L, and contains a vane wheel M, which is rotated by the upward current of gas impinging on it, and serves to effect an intimate mixture of the gas and air supply.

The burner-head carries at its centre a conical insertion piece having its apex directed downward, and which has for its object to deflect the mixture of gas and air, or the flame, towards the periphery of the mantle. Upon the gallery of the upper part of the burner is a short glass cylinder that only reaches to the top of the mantle. Into this cylinder reaches the lower end of a second narrower glass cylinder, which is suspended by means of its flanged upper end from the supporting plates. The air drawn in through the upper end of the cylinder Q flows downward along the outer surface of the second cylinder, and passes in a heated condition round the lower edge of the latter to the flame. The discharge chimney forms a continuation of this glass cylinder, and, together with a reflector, is supported by the plate S. Above the chimney are provided tubes with conically enlarged lower ends, which fit over one another like the nozzles of an injector, and can be adjusted vertically. The tubes contain a vane wheel X, which is rotated both by the ascending combustion gases and by the currents of outer air drawn in, so as to increase the suction

of the discharge chimney. Above the tubes is a deflector of curved form, and having a downwardly projecting pointed part "by means of which the ascending gases are deflected outwards without appreciably reducing their velocity."

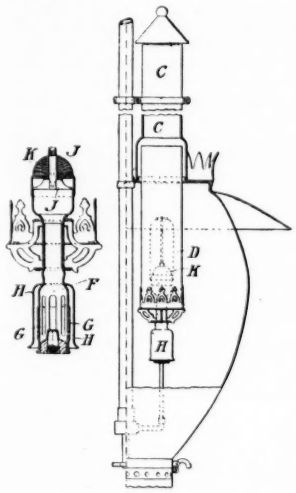
Gas Cooking Ranges.—Neil, A., Neil, W. R., and Fletcher, Russell, and Co., Limited, of Warrington. No. 4080; Feb. 18, 1902.

This invention relates to the hot plates of gas cooking-ranges, so as to enable the directions of the gas-jets in the grilling burners to be more easily changed, and to facilitate the removal and replacing of the grilling and boiling burners and the grid-bars when required to be cleaned.

Lighting by Incandescent Mantles.—Biheller, S., of Chiswell Street, E.C. No. 4534; Feb. 22, 1902.

In order that "a steady stream of gas and air in suitable proportions and thoroughly mixed may be supplied under forced draught to the flame, and that the flame be as large as practicable with a burner of given size," the patentee proposes the arrangement shown—one half of a lantern and a sectional elevation (on a larger scale) of the burner used in the lantern.

The general construction of the lantern calls for no description. In the top, however, over each burner (whether there be one or more) is an aperture having a flange at the top, which carries a metal cylinder C, so arranged that the products of combustion may escape while access of rain or other foreign bodies into the lantern is prevented. D is a chimney supported as usual, and leading into the enlarged lower part of the metal cylinder C. By these means a strong current of air is forced through the burner, and "the luminosity of the mantle is correspondingly increased."



All the parts of the burner are mounted as usual. From the supply pipe the gas issues through a perforated plate in the socket carrying the burner, passing into a chamber F, where it is mixed with air. To regulate the inflow of air there are long passages surrounded by a sleeve G, so that, by raising or lowering it, the inflow may be restricted or increased. The inflow of air is caused to be parallel with the flow of gas by fixing round the chamber F a hood H open below, and closely fitting the top of the chamber. I is the fitting that supports the mantle as usual. In burners of this class, as usually constructed, the fitting I is supported by a three or four armed bridge-piece, which considerably interferes with the flow of the mixture of gas and air—breaking it up into several currents. According to the present invention, however, the bridge J has only two arms, and is placed so that it presents a single thin edge (not a broad surface) to the flow of the gas, and is broadened at the centre to make it rigid. K is the wire-gauze top through which the mixture of gas and air issues to feed the flame. Usually this top is made flat or slightly convex; but the patentee constructs it as shown, so as to form a hemisphere or similar figure of considerable convexity, as he says it increases the size of the flame, and hence improves combustion.

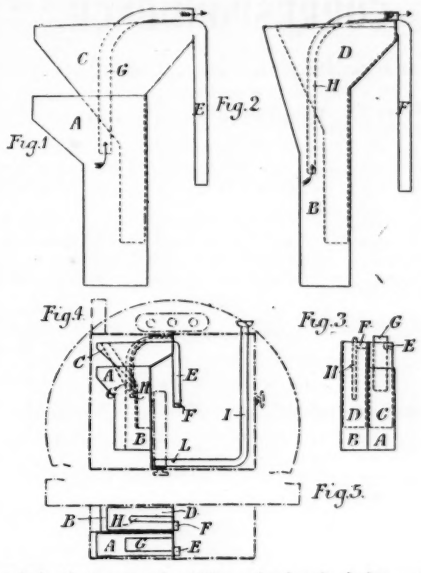
Gas-Meters.—Meerts, V., of Brussels. No. 5297; March 3, 1902.

This gas-meter "is based on the principle of the equilibrium of liquids in communicating vessels," and "has for its end the suppressing of the float and of the valve, thereby avoiding at the same time their defects, of which the most grave consists in allowing gas to pass which is not registered by the dial when the level of the water is too low."

Figs. 1, 2, and 3 show the containing vessels with their syphons, which constitute the essential element of the invention, and figs. 4 and 5 their arrangement in front of the meter.

A partition commencing at the opening of the middle wall forms a hermetically sealed compartment containing the inlet for the gas; and against this partition in the interior of the compartment are held two vessels A B, in which are plunged respectively the branches C D of two syphons of which the branches E F extend into the right-hand part of the body. The former branches are longer than the latter, and have a form proper to contain the greatest volume possible of water. In the vessel A is plunged also the tube G, of a section appropriate for the passage of a quantity of gas corresponding to the size of the meter; and in the vessel B is plunged the tube H, of more restricted section. These tubes (which have for function to conduct the gas from the closed compartment in the body) commence above the level of the water, and finish in the body (right-hand part) above the syphons. The tube of the funnel I enters the closed compartment below the vessels, and has at its lower part a hole L of 1 mm. diameter. The vessel B is deeper than A, to permit of priming only the syphon C E. The outlet of the branch E limits the lower level, and the outlet of the branch F limits the extreme line of the level of the water in the meter.

The apparatus works as follows: Water being introduced by the funnel I or by the gas-inlet, in rising in the closed compartment, arrives at the orifice of the vessel A, which it fills, primes the syphon C E, fills the vessel B in priming the syphon D F, and the running continues in the body (right-hand part) of the two syphons. The meter being filled to the proper level, the entry of water is stopped, and equilibrium is established between the vessels and the meter.



The gas-cock is then opened. When the level of the water lowers from the normal level M, the orifice of the tube E becomes free. The syphon then starts, and the water contained in the branch C fills the vessel A, closing up the passage of the gas by the tube G. The gas then passes only by the tube H, which is of sufficient section to maintain a small light. It merely suffices to add water by the funnel in order that the light shall be re established without risk of extinction.

APPLICATIONS FOR LETTERS PATENT.

10,456.—Scott-Snell, C., "Bunsen burners." May 6.
10,475.—Grubb, D. B., "Supporting the lamp-shades for gas-brackets." May 7.
10,480.—Fiddes, W. W., "Discharging coke from, and charging coal into, gas-retorts." May 7.
10,539.—Derval, E., "Inclined gas-retorts." May 7.
10,566.—Russell, E., and Willey, H. A., "Acetylene gas lighting." May 8.
10,601.—Kierzkowski-Steuart, C. F. de, "Generating high velocity gaseous jets for motive power." May 8.
10,608.—Altman, J., "Incandescent burner." May 8.
10,700.—Collier, A. T., "Internal combustion engines." May 9.
10,712.—Hooker, W., "Incandescent lighting." May 9.
10,730.—M'Kinlay, R., "Drawing gas-retorts." May 9.
10,736.—Redmayne, L., "Adapting coal ovens for gas-cooking." May 10.
10,752.—Moorhouse, J., "Incandescent gas-fittings." May 10.
10,757.—Schönfelder, H., and Stefan, W., "Gas-burners." May 10.
10,764.—Schwarz, H., "Gas and like engines." May 10.
10,784.—Anderson, J. C., "Liquid meters." May 10.
10,789.—Helps, G., "Fittings for gas-lights, and boxes for carrying the same." May 10.
10,824.—Martin, P. A., "Incandescent gas-burners." May 12.
10,840.—Ryland, T. G. F., "Incandescent gas-burners." May 12.
10,871.—Higgins, W., and Shaw, P. G. C., "Combustible vapours for lighting, heating, and motive purposes." May 12.
10,876.—Feld, W., "Treatment of coal gas for obtaining soluble cyanides." May 12.
10,914.—Murray, T. R., "Endless conveyors for the carriage of coal, coke, and similar substances." May 13.
10,946.—Tatam, G. W. G., "Separating the emulsion produced during the washing, scrubbing, and condensation of crude carburetted water gas into two fractions—viz., (*a*) tars and oils, and (*b*) water containing small quantities of tarry matter." May 13.
10,951.—Rew, R. J., and Salari, J., "Burners of gas-stoves." May 13.
10,982.—Alafalla, P. B., "Gas-meter." May 13.
11,019.—Bray, J. W., "Terminals for lamps for public lighting." May 14.
11,042.—Terrel, T., "Incandescent mantles." May 14.
11,069.—Sugg, W. T., "Incandescent gas lighting." May 14.
11,093.—Rainey, C., "Carburettors." May 14.
6240A.—The Hygienic Stove Company, Ltd., and Greenwood, E. P., "Gas cooking-stoves." May 15.
11,131.—Bray, J. W., "Acetylene burners." May 15.
11,152.—Ehmann, C. P., "Atmospheric gas-burners." May 15.
11,172.—Hollis, W., "Fastening for purifier-covers" May 15.
11,191.—Hooker, W., "Incandescent gas-burners." May 15.
11,212.—Goodson, J., "Gas-governors." May 15.
11,215.—Weiss, A., "Gas-burners." May 15.
11,222.—Clark, W. L., "Automatic appliance for lighting and other purposes." May 15.
11,227.—Ruscoe, J., "Fixing branch water and gas mains, and other connections, under pressure to leading mains." May 16.
11,268.—Hartley, J., "Incandescent gas mantle fork clip and holder." May 16.
11,280.—Schottmann, F. C., "Incandescent mantles." May 16.
11,328.—Webber, W. H. Y., "Improvements in gas manufacture." May 16.
11,414.—Cox, W., and Glover, G., and Co., Ltd., "Coin-controlled apparatus for delivering gas and like fluids." May 17.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Flame Luminosity and Cheap Gas.

SIR,—Surely Mr. Glasgow does not expect your readers or myself to be led into any false issues. What can any argument derived from my paper, which was not written at the time he made his attack, have to do with it.

My challenge is simple. On what basis does he condemn the policy of the three London Companies in obtaining a reduction of the parliamentary standard of illuminating power, and how can he justify his statement that gas conforming to the 16-candle standard can be made for 1s. per 1000 cubic feet?

Until he answers these simple questions, I dispute the propriety and the pertinence of his intervention; I nearly said intrusion.

Commercial Gas Company, May 26, 1902. HY. E. JONES.

Gas Undertakings and Mantle Agreements.

SIR,—I have been asked what is the advantage of entering into an agreement with the Welsbach Company; and as probably the same question has arisen in other cases, I shall feel obliged if you will allow me to use your columns for an answer.

Without the agreement, mantles can only be purchased of the Welsbach Company, and other makers who are licensees of the Company, on any terms that may be arranged without paying any royalty. With the agreement, in addition to the above, gas undertakings can manufacture mantles on their own account by paying a royalty of ¼d. per mantle. The manufacture of mantles is not a difficult or an expensive process. Consequently, if satisfactory terms cannot be made with the Welsbach or their licensees, those under agreement can make for their own use. They can also buy of any other maker or importer, or import for themselves, by paying ¼d. per mantle royalty. Further, there is a favoured nation clause in the agreement providing that, if the Welsbach Company hereafter grant to any other gas undertaking better terms, the same shall apply to those under agreement. The agreements, in fact, enlarge the area and increase the freedom of the purchase of mantles; and they cost practically nothing.

Another difficulty has arisen. The Board of a rather prominent Gas Company—not the smallest in existence, and not one of the guarantors—wanted an agreement, but objected to the printed form, because my name appears in the preamble: "Whereas, as the result of negotiations entered into," &c., &c. This very small difficulty was overcome by exchanging letters, practically embodying the terms of the agreement. In some other cases, slight verbal alterations have been made; but no alteration has been made in the terms in any of the considerable number of agreements that have already been exchanged.

I promised the Welsbach Company that I would do my best to procure agreements, believing that they are advantageous to gas companies and to corporations supplying gas (a number of the latter joined the guarantee fund). I address this letter to any who may be hesitating or in doubt.

May 24, 1902. GEORGE LIVESEY.

SIR,—Many thanks for your publication of my letter, and for your leaderette. I note you did not publish copies of my letters to Mr. Livesey and his replies, which were submitted to you.

I do not think you have given the subject due consideration, or you would not suggest that I have no claim on the guarantee fund because it was subscribed by gas undertakings. They, of all interested, profit most by this settlement. I contend, as it cost £3000 to bring about a peaceful solution without a trial, the gain in treasure alone is enormous to the gas undertakings, as, had they gone on with their "break-up" scheme, thousands would have been spent by both sides in law. The case would have dragged on in any event to the Lords; and four years would have been lost, and trade development retarded. All this now is altered. The expense is saved, and a working arrangement is made possible in getting co-operation of the trade. Had the Welsbach Company fought the Guaranty and Voelker Companies, they would have crushed these two as they (the United Chemical Company and the Voelker Company) were powerless, without the co-operation of a certain Solicitor, to defend themselves. Had Mr. Livesey not agreed to "peace," I know the trade, being willing to fall in with my proposals, would have combined to help the Welsbach Company. The gas companies would have spent thousands; and the Welsbach Company would have been victorious, and able then to dictate their own terms to the above. I maintain that the trade combination has been salvation to the gas companies, and made it possible for Mr. Livesey to carry out his maintenance scheme. Progress is now possible. The clock is not put back, but all can go ahead. Mr. Livesey and Mr. Keith attain their object, and get a substantial reward.

You did not remark on the strange coincidence that Mr. Livesey, though starting to break up the Welsbach Company, should adopt (chapter and verse) the terms I proposed. It should not be left to me to call attention to my claim. A more graceful act would have been for Mr. Livesey to have offered me a recognition. I am convinced, if my claim had been put before the Committee, generous and substantial reward would have been accorded me. The trade fully recognized me, and will no doubt keep to promises made. The Guaranty and Voelker Companies, as well as the gas trade, all profit by my services, and should make the same recognition. There is yet time for them to acknowledge the services rendered by me.

May 22, 1902. D. EDWARDS-RADCLYFFE.

The "Positive" Meter.

SIR,—Respecting the two letters that have appeared in your columns from Mr. Greenall, under this head, I consider there is very little to reply to or comment upon.

The meter I complained of has simply repeated its performance since the Boston meeting, and the cause of its vagaries has proved to be the valves, as explained in Mr. Greenall's last letter. As Mr. Greenall truly says, this does not affect the principle of the meter. Quite so! But as the valves form an integral part of the complete mechanism, and their right acting is vital to the accurate working of the remainder, the same fault must of necessity attach to this meter as to ordinary drys—*i.e.*, so far as the valves are concerned; and this was the gist of my remarks at the Boston meeting.

As to dispensing with valves. I am not aware that anyone made such a suggestion. My own remarks were: "If Mr. Greenall could have effected as great an improvement in regard to the valves as he had made in other parts of the meter, it would be quite worthy of the name 'Positive' in every respect."

The greatest losses of gas—to the supplier—through dry meters are, I still hold, caused by defective working of the valves; and in that sense I consider them to be the weakest part of the ordinary dry meter, as they have proved themselves to be the weakest part of the "Positive" meter.

Grantham, May 21, 1902. R. G. SHADBOLT.

Sons of the Gas Industry.

SIR,—It is pleasing to find that at least one of the sons of our industry has taken an evident interest in your recent articles on the absence of facilities for the education of the juniors of the gas industry. But I must confess to a feeling of disappointment on reading the contribution of your somewhat contented correspondent, who prefers to be known under the *nom de plume* of "Marmion." Although he does not make a positive assertion that Associations are of no practical value to students, I think we may conclude that he holds this opinion. He has evidently formed the impression that Association meetings are simply organized as social gatherings, or mere entertainments. If this was really the case, I should be inclined to agree with "Marmion" in his conclusions; but as one who has been closely connected with the Manchester Junior Association since its inauguration, I have no hesitation in stating that the meetings must have been of great practical value to its members, inasmuch as the reading of papers, visits to works, and exchange of opinion are bound to modernize the ideas and extend general knowledge, and will consequently better the member for the performance of his duties. In this, I feel sure that I am voicing the feelings of the whole of our membership. The amount of benefit to be derived from such meetings absolutely depends upon the motive of the member who attends. If, like "Marmion," we go with the idea that we are attending a mere "social affair," then I can quite conceive that the meetings will not be of much practical value to such members. But, on the other hand, if we attend with a genuine desire to extend our knowledge, we are bound to be benefited thereby. I quite agree with "Marmion's" closing suggestion, that a three years' training under a good gas engineer is desirable; but I am inclined to think that this is, unfortunately, out of the question with the majority of the junior members of our industry.

I also agree that mere attendance at an Association meeting or technical class and "the holding of certificates" do not necessarily qualify a man to creditably fulfil the duties of the higher positions. But as you, Sir, point out in your comment, it proves that a worthy effort has been made on the part of the student to render himself qualified. Is not this part of the "technical education" which "Marmion" himself advocates?

In face of the fact that almost every profession and industry has its own Association, that year by year papers are compiled and read, and visits arranged for the general advancement of education among its members, that educational authorities are now more than ever on the alert to provide facilities for the student intent on securing the coveted "certificate of merit," and that to-day there are a large number of students who are endeavouring to secure the certificate, "Marmion" contends that all this is of no "practical value," and that it does not help a man in his particular profession. Surely "Marmion's" criticism must awaken the authorities from their lethargy, and induce them to provide something more practical than the present "social affair" at which "useless" papers are read, which are absolutely "no good" (so "Marmion" says), and the system at present in vogue of arranging "picnics" to gas and engineering works.

Despite "Marmion's" opinion, I am certainly convinced that the Manchester Junior Association has supplied a long-felt want in the Manchester district; and I have not the least doubt that similar Associations could with advantage be formed at convenient centres throughout the country. We have met with every degree of encouragement in our own district from engineers whose works we have had the privilege of visiting; and I do not think that there is any reason to suppose that similar courtesy and kindness would not be meted out to juniors in other parts of the country. This is a matter entirely in the hands of the juniors themselves, which, if adopted, I feel sure would be to the advantage of the industry as a whole; and if the recognition and assistance of the Senior Associations could be secured, the status of the organizations would be raised, and a greater degree of success attained.

Littleborough, May 23, 1902. S. E. HALLIWELL.

SIR,—The keynote of your correspondent "Marmion's" letter appears to be that only through the service of a term of articles lies the royal road to efficient gas engineering; and the unlucky individual who starts life without the necessary funds, but possesses merely brains for his capital, has no right to aspire to any post beyond the decidedly junior ones in a gas-works. Unfortunately for such an "outsider," this opinion is one shared by many engineers. And who can blame them? To do away with pupils, is to lose a sure source of revenue.

It may not be out of place here, however, to make a brief comparison between the training of articled pupils and the "back stair" men. Taking "Marmion's" own words, "a good, sound technical education, followed by two or three years' training on a works under a good engineer," let us see how it works out in practice.

The embryo gas engineer starts life in comfortable circumstances—the very best inducement to habitually study personal ease—is put to a good school, and, at the latter part of his scholastic term, goes in for a few chemical fireworks and a smattering of machine drawing, &c. He then enters upon the serious portion of his training in a gas-works. He is allowed a good deal of license, which would not be accorded to any ordinary employee; and, in the majority of cases, he takes prompt advantage of it.

Let the engineer be ever so clever, he cannot enforce the attention to duties which he can demand in a paid servant; and the cultivation of outside pleasures and sports frequently holds a far higher place in his pupil's estimation than "gas." At the end of his period of service, it is the bounden duty of the engineer to see him successfully placed. On the other hand, a youth commences work in a gas-works in a very subordinate position, but with a strong determination to acquire a full knowledge of the profession. Not perhaps possessing equal educational advantages, he attends technical evening classes; and his motto being *en avant*, he gains certificates for proficiency in chemical and engineering subjects. After a time, he is qualified to attend a course of "Gas Manufacture," leading up to City and Guilds certificates. Not having the same privileges as the articled man, the very difficulty of acquiring information impresses it upon his mind.

Now is the time when a Junior Society becomes invaluable. Here he can meet with others having like aims, but with perhaps more experience than himself, exchange views, and ask questions. A technical paper is brain food to him; visits to different works afford him an opportunity of seeing processes and plant which he would otherwise never come across; and thus he is capable of answering the very practical questions set in the City and Guilds examinations. His eye and intellect are constantly at work to assimilate fresh ideas. Such a man would never dream of applying for a management under ten years of expe ience; and who shall say he is not equal, if not superior, to his more fortunate rival with three or even five years' experience. It may be said that the comparison is unfair—that the clever employee is pitted against the worst type of pupil. So it is in real life. All honour to the articled pupil who turns out a credit to his profession. No one would grudge him his success.

The Manchester Junior Association has done splendid work in the short time it has existed. It may not be generally known that a similar institution existed in London, but dragged on a very precarious life for about five years, owing to lack of interest shown by the southerners. Why it is that there is more energy in the North of England it is hard to say; but the fact nevertheless remains.

It is a pity the Gas Engineering Society should be allowed to die, especially as the members must recognize the fact that they are wiser men to-day for their attendance at its meetings and visits.

"DOUGLAS."

May 24, 1902.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, May 15.

(*Before the* LORD CHIEF JUSTICE *and Justices* DARLING *and* CHANNELL.)

Smith v. Corporation of Southampton—Levying a District Rate.

This was a special case stated by the Recorder of Southampton in an appeal made by Mr. C. Crowther Smith, the Secretary of the Southampton Gas Company, against a rate levied by the Corporation in respect of property in the added areas of the borough. Four amounts were in question; and the decision at Quarter Sessions was in favour of the appellant.

Mr. J. A. FOOTE, K.C., and Mr. FORDER LAMPARD appeared for the appellant; Mr. A. MACMORRAN, K.C., and Dr. S. H. EMANUEL represented the respondents.

Mr. MACMORRAN said this was a special case stated by the Recorder of Southampton on an appeal against the general district rate made by the Corporation on the 12th of June, 1901. There were two distinct questions arising on it. The first was whether the rate might be said to be invalid because it was made to include retrospective charges; and, secondly, whether it was so by reason of the added areas of the borough having been charged sums of money in excess of those which they could be charged with under the Provisional Order duly confirmed by the Local Government Board and by statute. The second point was entirely distinct from the first, and turned simply upon the construction of one or two clauses in the Order; but the first was one of some difficulty, and raised questions of importance. Counsel then read the case, which set forth that the appellant was a ratepayer at Shirley—a district which up to 1895 formed no part of the county borough of Southampton, but which, with other districts, known and described as the "added areas," became part of it by virtue of a Provisional Order granted by the Local Government Board. The respondents, acting by the Town Council as the Urban Sanitary Authority, on the 12th of June, 1901, made a general district rate on the whole area of the borough to enable them to defray expenses incurred or to be incurred for the period commencing the 1st of April, 1901, and ending the 31st of March, 1902. Before proceeding to make the rate, the respondents, pursuant to section 218 of the Public Health Act, 1875, caused an estimate to be framed; and on the 22nd of May this was approved by them, duly entered in the rate-books, and kept at their office for inspection. The books containing the estimate and the rate were before the Recorder; and the total expenditure of the borough for the year ending March 31, 1902, was reckoned at £110,454 4s. The income estimated, apart from the rate to be levied, amounted to £14,379 6s. 3d.; leaving £96,074 17s. 9d. to be produced by the proposed rate to complete the sum required. The appellant, alleging himself to be aggrieved by the rate, duly appealed against it on the grounds set forth in his notice of appeal, which formed part of the case. He contended the rate was bad because it included retrospective charges—in particular, certain charges which had been incurred or become due more than six months before the rate was made, contrary to the provisions of section 210 of the Public Health Act, 1875. The principal items so objected to were £1463 3s. 10d., balance of suspense account for 1900 upon the electricity works; £220 11s. 10d., deficit for the year ended March 31, 1900, on the electricity account; £2154 8s. 1d., one-fifth liability to bank, pursuant to the resolution of the Council on March 27, 1901; and £903 os. 4d., due on capital and suspense account. As to the first two of these items, on March 31, 1897, there was to the credit of the revenue account a balance of £21 2s. 5d. On March 31, 1898, a deficit on working of £18 16s. 9d. caused a debit balance of £1188 os. 9d.; and a suspense account was opened, and the amount carried thereto. On March 31, 1899, a deficit of £640 19s. was also charged to the suspense account, which was thereby increased to £1828 19s. 9d. On March 31, 1900, one-fifth of the £1828 19s. 9d. was written off, and charged to net revenue account—the suspense account being thereby reduced to £1463 3s. 10d.; and a further deficit of £220 11s. 10d. on the working for the year appeared on the net revenue account. The third item objected to was £2154 8s. 1d., being one-fifth of £10,772 os. 3d. outstanding on special suspense account on March 31, 1901, which was dealt with by resolution of the Council on March 27 as follows: "That the balance of liabilities omitted in the estimate for the year 1900-1 be placed to a special suspense account, and spread over a period of five years." The fourth item objected to—£903 os. 4d.—appeared in the estimate as one-fifth of the expenditure payable out of revenue, and represented one-fifth of £4515 1s. 8d. for works executed before the added areas became part of the borough. For the respondents it was not denied that the four items were retrospective charges, but it was contended on their behalf that there was no proof that they were included in the rate, and that as the estimate was not, according to the Act, to be "deemed part of the rate, nor in any respect to affect its validity," it ought not to be received in evidence; and the estimate did not show that the four sums, or either of them, were included in the rate. The Recorder came to the conclusion that there was *primâ facie* evidence that the sums objected to were included in the rate; and he further held that, even if the respondents were at liberty to appropriate the balance income of £14,379 6s. 6d. to the items objected to, which there was no evidence that they had done, yet, as the effect would still be to increase the rate by the amount of such items, the rate would be equally retrospective, both in law and in fact, as if such appropriation had not been made. Besides this, the respondents contended that the sums were not incurred, and did not become due, more than six months before the rate was made, but formed part of the overdraft of £161,794 8s. 8d. due to their bankers on June 13, 1901; and their liability to their bankers on this overdraft had been incurred since Dec. 13, 1900, by reason of the payment into their credit of £556,351 15s. 1d. between Dec. 13, 1900, and June 13, 1901. These items did not exist as charges, but were covered by the current overdraft at the bank, which, being balanced every day, was not a charge incurred more than six months prior; and so far as the original creditors were concerned, they had been repaid, but with money borrowed from the bank. Except in the one instance of £2154 8s. 1d., the charges did not appear in the estimate as a debt due to the bank. They appeared as liabilities already incurred on March 31, 1900, which was more than six months before the making of the rate; and the Recorder found as a fact that they were so. The respondents further contended that the inclusion of the sums, or one or more of them, in the rate was not a ground for quashing it. The Recorder found that the four sums named were proved to be for charges incurred more than six months before the making of the rate, and that they did not come within any of the exceptions to the general rule that the rate was bad. He further held that, inasmuch as the respondents had no statutory or other authority to borrow from the bank for the purpose of discharging old liabilities, the form in which the account between them and the bank was kept did not prevent the rate from being retrospective. Counsel concluded by saying that the rest of the case related to the second question; and, if convenient, he would deal with it later.

The LORD CHIEF JUSTICE: Assuming that the Recorder was right that these items had to be excluded, how would they be met?

Mr. MACMORRAN replied that they would have to meet them in some other way.

Mr. FOOTE stated that what would have to be done would be that they would have to get a loan with the sanction of the Local Government Board or by an Act of Parliament.

The LORD CHIEF JUSTICE asked how the loan would be repaid.

Mr. FOOTE said, if it was sanctioned by the Local Government Board, it might be paid by a sinking fund, and, with interest, be made a charge on the rate.

Mr. MACMORRAN said the Local Government Board had no power to sanction except pursuant to statute. If they were illegal charges, they could not lawfully be paid, and the bank would not be paid.

Mr. FOOTE remarked that the Corporation would have to get an Act of Parliament.

Mr. MACMORRAN said there was no provision for this in the Public Health Act.

The LORD CHIEF JUSTICE said what he wanted to know was whether there was any Public Health Act machinery under which a difficulty of this kind could be dealt with.

Mr. MACMORRAN said there was no provision in the Public Health Act. He went on to say that he was going to show, from the documents exhibited in the case, that these charges were not really retrospective, and that the only evidence that they were was that derived from the estimate on which the rate was founded. In order to get at once to the point he wished to raise, he called attention to section 218 of the Public Health Act, 1875, contrasting it with the previous Act of 1848, and quoted the Worksop case; contending that the estimate was not to be deemed part of the rate or in any respect to affect the validity of the same. What was meant was that if the rate was liable to be quashed by reason of the estimate having in it some illegal charge—some charge which was retrospective or otherwise illegal—the object of the Legislature was only to give information to the ratepayers. After

further arguments, Counsel went on to say there was nothing to show that the items objected to were not paid off in the year ending March 31; there was only the general deficit carried forward to the next rate. Another point was that the difference between the district rate and the amount of the expenditure was somewhere between £14,000 and £15,000, and the rate did not cover the whole of the estimated outlay, as there were other receipts; and he saw no reason why they should not make their retrospective payments out of those.

The LORD CHIEF JUSTICE asked if the real trouble was not brought upon themselves by the Corporation putting into the estimate—it might be in their favour, in one sense—a number of items which did not represent expenditure going to be paid off by loans.

Mr. MACMORRAN said it seemed by this very balance-sheet that the Corporation anticipated so much revenue apart from the rate. That revenue was amply sufficient to cover, and more than cover, the whole of the items objected to; and it did not at all follow that the rate would be applied to the payment of any single one, assuming they were wholly illegal. This being the case, the real remedy, if anyone objected to the payment, was not by an appeal of this kind. If it could be shown that money raised out of the rates was actually going to be applied to the payment of an illegal charge, it could be stopped, or there would be a proper surcharge. But in this case, it did not at all follow that any part of the money payment to which there was an objection came out of the rates; and his submission was that it would be quite lawful to pay debts more than six months old out of moneys which came into their hands otherwise than out of the rates. Counsel next proceeded to deal with the second point in the case, and brought his argument to a close.

Mr. FOOTE, for the original appellant, was not called upon to reply.

The LORD CHIEF JUSTICE, in delivering judgment, said the questions raised in the course of the case were of great importance, and were to a certain extent difficult until they were clearly explained, as they had been by Mr. Macmorran in his arguments. He thought, before he dealt with the facts, he had better say a word upon the law, as he understood it, applicable to the case. By section 210 of the Public Health Act, 1875, the general district rate, which formed part of the general district fund when it was collected, had to be levied in order to raise money for the payment of future charges and expenses, or retrospectively in order to raise money for the payment of charges and expenses incurred at any time within six months before making the rate. In calculating the period of six months during which the rate might be made retrospectively, the time in which any appeal or other proceeding relating to such rate was pending should be excluded. Therefore there was an express statutory prohibition, and a very distinct one, against allowing a retrospective payment to be included beyond a period of six months; and all the more so because money might be raised by rate to make the payment retrospectively for a certain period. Obviously, therefore, it was a matter of importance; and they had met the difficulty which corporations or public bodies would have in making these payments by fixing the period of six months. Then there was the general right of appeal under section 269 of the Act; and, notwithstanding all that had been urged before the Court by Mr. Macmorran, he thought it would be extremely difficult to say that *primâ facie* there was not a right of appeal in respect of a rate that was levied and purported to be levied in respect of charges which were not authorized by section 210. It was expressly decided in the Worksop case in 1857 that there was such a right. It appeared that in the present instance there was included a balance of the suspense account for the year 1900 upon the electricity works; that there was included a deficit for the year ending March 31, 1900, on the electricity account; that there was included the one fifth liability to the bank pursuant to the resolution of March 27, 1901, of £2154; and £903 due on capital and suspense account. As to the £2154, there was a resolution on March 27, 1901, that the balance of liabilities omitted in the estimate for the year 1900-1 should be placed to a special suspense account, and spread over a period of five years; and there was one which was practically the same with regard to the £903, the one-fifth of expenditure payable out of revenue. It represented one-fifth of £4515 1s. 8d., a total of certain following items in respect of works done in the years and with the objects specified, going back a great many years. In this state of things, it certainly did appear that, in order to meet a number of items, amounting to a very considerable sum, which had been incurred beyond the six months period, it was necessary to raise, as a mere matter of what he might call a debtor and creditor account, this general district rate, which amounted to upwards of £96,000. Therefore, unless the Corporation were able to show that this was only bookkeeping—that they were, in fact, meeting these amounts out of another purse than that which would be filled by the general district rate—there certainly was evidence on which the Recorder was entitled to come to the conclusion that they were paying these debts out of the moneys to be raised by the rate. The first and broad contention seemed to him really, for the reasons stated in the very careful judgment of the learned Recorder, to be untenable. It was said that they borrowed money from their bankers, and that it was to meet this debt that they had to raise the general district rate. It seemed to him that if this line of argument were allowed to prevail, they had only to arrange with their bankers to borrow money to pay their debts, and get round the provision of section 210 altogether; and he could not think this was right. The other answer that was raised was that they might take the £14,000, which were receipts other than the £96,000 raised by the general district rate, and assume that the sums would be paid out of that. He thought the judgment of the learned Recorder on this answer was perfectly sound—that, even if they did, they got the amount increased, and therefore they did, in reality, pay those debts out of the rate, which was a clear breach of section 210 of the Act. This, therefore, disposed of the first objection taken to the Recorder's judgment, as to there being payment of debts more than six months old out of the general district rate, which showed, in his opinion, that the rate was levied in order to raise money to meet these charges. As to the second point—the imposition upon the added districts of certain charges which it was considered should be confined to the borough as it existed at the time of its extension—he thought when the Provisional Order was read there could be no doubt on the point at issue. In his opinion, the learned Recorder had come to the right conclusion on this point as well as on the previous one.

Justices DARLING and CHANNELL concurred.

The judgment of the Court of Quarter Sessions was therefore affirmed, and the appeal dismissed, with costs.

BRIDLINGTON COUNTY COURT.—Thursday, May 22.

(*Before His Honour Judge* RAIKES.)

Bridlington Gas Company v. Pearson—Damage to Gas-Pipes through Drainage Operations.

This was a case in which the Bridlington Gas Company claimed £43 11s. 8d. from Mr. G. W. C. Pearson, of Hull, the Contractor for the main drainage scheme now in progress in Bridlington, in respect of damage caused to their property, and loss of gas resulting from such damage.

Mr. WEST appeared for the plaintiffs; and Dr. WOODHOUSE represented the defendant.

Mr. WEST explained that the scheme consisted of the putting down or renewal of the sewer leading to the main outfall just above the harbour at Bridlington, at which point the Gas Company had had two mains—a 3-inch main which had been in the ground for some time, and a 6-inch main which was laid three or four years ago. These mains had been damaged. The Company's contention was that they were previously in good condition. When the sewerage pipes had before been opened up, the Company had had no such trouble as on this occasion. The plaintiffs contended that the work could, with proper care, have been carried out without harm to their mains; and the damage caused was mainly due to the pipes being badly supported by the Contractor's agents. Breakages had occurred on Feb. 1 and 10, and on several dates in March.

Mr. *J. C. Archer* said he had been Secretary to the Company since 1873. He could not remember the 3-inch main being put in; but he believed, from the memoranda in the Company's books, that it was in 1874. They had had no trouble with the mains until now. The 6 inch main was put in four or five years ago. He first heard of the damage to the pipes on Feb. 10. He had seen the works before, and had called a man's attention to the fact that the mains were being insufficiently supported. He did not know who this man was; but he thought he was a foreman or ganger. He had told him that if they were not more careful there would be a fracture. On going into the works on Feb. 10, he found there was scarcely any gas in the holder; and when he afterwards went to the scene of the drainage operations, he found the men at work stopping the breakage. Two of the Company's men were rendered unconscious by the gas. He believed the breaks would not have occurred if the mains had been well supported. He calculated that at least 125,000 cubic feet of gas had been lost. Since it had been fractured, the part of the 3-inch main damaged had been cut away.

In cross-examination, witness admitted that the Company did not periodically inspect their mains. They could not be constantly overhauling the streets, or the Council would be down upon them.

Dr. WOODHOUSE: Then you would not have examined the mains if no complaint had been made to you?

Witness: No. We do not take up the mains unless it is necessary to do so.

Dr. WOODHOUSE handed witness a dilapidated service-pipe, which he said had been taken from Alma Terrace. It had six holes in it, and was twisted.

Witness said such a pipe, if found by the workmen of the Company, would be taken out.

Dr. WOODHOUSE: You wait until there is danger, and then you examine them?

Witness: Well, we should never be done if we did otherwise.

Dr. WOODHOUSE said the reports of breakages Mr. Archer had spoken of had come from Mr. Pearson. While Mr. Archer wrote to Mr. Pearson on Feb. 10, a report had been sent to the gas office the day previous (a Sunday).

Witness: We did not hear about it.

Dr. WOODHOUSE: But you have no one inspecting—night, day, or Sunday. There might be a serious leakage on a Sunday, but you would not see to it until Monday. When the first complaint was made, did you not state to the man who had reported it that you were too busy to attend to it?

Witness said that could not be, as the men were at work on the break at the time.

His HONOUR: What do you mean by "at the time?"

Witness repeated no such reply had been given to anyone as that there had been no time to attend to the break. The men would be sent to it as soon as the Company's officials were aware of the matter. The Company knew the drainage work was proceeding; but they had not detailed anybody off to look after their interests. Their men went down occasionally, but not regularly. It was not for the Company to interfere with Mr. Pearson or his men.

Dr. WOODHOUSE: Oh, no; you knew the age of the pipes, but you never thought of writing to warn Mr. Pearson.

John Porrie, foreman engineer and fitter to the Company, said the 3-inch main was laid before he entered the service of the Company. On Feb. 10, in consequence of a report, soon after 7 o'clock a.m. he sent two men down to the drainage works. He had not previously had a report. The two labourers returned about 8 o'clock, and reported to him; and he sent them back, following them. He got to the place about 9 o'clock. The 3-inch main had a large fracture in it, and was partly "settled down." One portion of the main was about 2 inches lower than the other. The cause of the fracture was that it had not been supported. He saw several loose pieces of timber; but they were not fixed. The main should have been supported by struts fastened into the solid ground, before filling in. He saw no struts. He found

the two men who were repairing the pipe unconscious—"gassed." The break had taken place close to the centre of the trench. The main was in very good condition. He produced the piece of pipe in which the fracture had occurred. Another report reached him on the 12th of the fracture of a 3-inch main. There was "wailing" in the trench; but the main itself was not supported. The pipe would have borne any ordinary strain. He had cut the piece of piping produced by the defendant about a fortnight ago. It had not been used for years. He had cut it off and left it in the trench.

His HONOUR here interposed; remarking that he could not see how the plaintiffs, in view of the evidence of Mr. Archer, were going to get rid of a charge of contributory negligence. They knew of the works, and that the pipes were likely to be bared; but they had taken no steps to see that it was properly done. Someone spoke to someone else about the danger; but they did not follow up the work. The Company did not get rid of their responsibility in that way. It seemed to him there was a very serious obstacle in the way of a verdict for the plaintiffs, on the admissions of their own witnesses.

Mr. WEST insisted that he did not see any duty had been cast upon the Company to examine the pipes laid bare by defendant.

Dr. WOODHOUSE, in support of his Honour's contention, quoted the case of *Mose v. Hastings and St. Leonards Gas Company*, in which it was clearly stated that the duty of a gas company was to frequently make an inspection of their mains and service-pipes.

Mr. *C. H. Kirby*, in the service of the Corporation, gave evidence as to the steps he had taken to support the water-mains, which had been broken several times before Feb. 10 He had purchased wood, and had had the pipes properly held up.

His HONOUR said that witness had done for the Contractor what the Gas Company had not done. Instead of warning him that the Council would hold him liable for any damage to the water-mains, witness had had the damage averted. He was not prepared to say the Contractor had not also been negligent; but it was clear to his mind that the Gas Company had been negligent of their own interests.

Dr. WOODHOUSE said plaintiff was prepared to prove that no negligence had occurred on his part. The drainage operations were public works, being carried out under the Public Health Act; and the Gas Company had plainly neglected their duty.

Mr. WEST insisted that it was the duty of the defendant to take proper care of the property of the Company. Why a contractor should be relieved of his responsibilities because he was not watched, was a new proposition in law to him. Even if there was negligence on the part of his client, the Contractor ought not be allowed to go free, for he, too, had been negligent. He therefore asked his Honour to divide the damages.

His HONOUR said he could not do that, as the law would not permit of it. The plaintiffs had done nothing to protect their own interests. He had not the smallest doubt in the case. The Company had been very negligent; and then they came there and claimed damages. They could not get them. There would be judgment for the defendant.

Fracas at the Dublin Gas-Testing Station.

On the 16th and 17th inst., at the City Sessions, the Recorder of Dublin (Sir Frederick Falkiner) was engaged in hearing two cases arising out of a disturbance which took place between the representatives of the Company and the Corporation at the public testing-station in Townsend Street. In the first action, Mr. Thomas J. Cotton, the Inspector of Public Lighting and Gas Examiner to the Corporation, sued Mr. Joseph W. Brent, a clerk in the service of the Gas Company, for the recovery of £50 damages for assault and battery; while in the second ca e, Mr. Brent claimed £20 damages from Mr. Cotton for assault. Mr. Healy, K.C., M.P. (who appeared for Mr. Cotton), said that on the occasion in question Mr. Cotton was accompanied, when going to make the test, by an assistant named Fell. When Mr. Cotton was performing the test, Mr. Brent took up his stand right behind him. Mr. Cotton asked Mr. Fell to bring his chair nearer; but Mr. Brent kicked it away. Some discussion thereupon ensued, at the end of which Mr. Brent seized the chair and smashed it down on Mr. Cotton's head—opening his forehead and cutting his nose—afterwards "pounding him on the face." The Gas Committee, on being informed of the incident, requested the Company to withdraw Mr. Brent from the station, for the sake of quietness; but this the Company refused to do. Mr. Cotton bore out Counsel's statement, and said that all he did was to catch hold of Mr. Brent's tie, to avoid a second blow from the chair. Mr. O'Shaughnessy, K.C. (for Mr. Brent), remarked that this was a paltry squabble, magnified by the relations of the past eleven or twelve years into a matter of so-called importance. Whenever a complaint had been made Mr. Brent had been found to be in the right. On this particular occasion, Mr. Cotton brought the chair close to Mr. Brent, and put it down on his toes. On Mr. Brent complaining, Mr. Cotton repeated the manœuvre; and the two men then struggled for the chair. In the scrimmage, Mr. Brent's hand was cut by the chair, and Mr. Cotton was struck by it; and out of this was made the case that Mr. Brent deliberately took the chair and hit Mr. Cotton with it. Mr. Brent, in his evidence, said there was not a word of truth in the statement that he took the chair and brought it smash on Mr. Cotton's head, or that he struck Mr. Cotton on the face. Further evidence at great length having been given, the Recorder delivered judgment. He said he believed that Mr. Brent did not intentionally dash down the chair on Mr. Cotton; but it was very likely that he at any rate endeavoured to give him a tap with it, and he could not but think that he pommelled him afterwards. He could not, however, get over the fact that Mr. Cotton had been fighting the officials for the past thirteen years, while Dr. Tichborne had been acting perfectly amicably with them. Mr. Cotton was a distinguished officer of the Corporation; and he could not find fault with him in what he was going to do—namely, to give him a sum which would cover his necessary expenses, dealing with the case as one in which there were faults on both sides. In the action of Mr. Cotton against Mr. Brent, he gave a decree for £40, which he thought would cover all reasonable costs. He dismissed Mr. Brent's action against Mr. Cotton.

MISCELLANEOUS NEWS.

FIRE AT THE WELSBACH STORES.

A serious fire occurred on the Westminster premises of the Welsbach Company last Tuesday; but its real gravity was strictly confined to the duration of the outbreak. With their usual eagerness for sensational fare to serve up to their readers, a section of the daily Press magnified the event and the details beyond all truth. The outbreak occurred about 8.30 in the morning; and about an hour afterwards the fire was completely subdued. A visit to the premises the following day revealed the actual state of affairs. The offices and show-rooms of the Company have their frontage on York Street, and these are untouched; the trade department faces on to Palmer Street, and this also escaped injury; but the store-rooms at the back which form the rear boundary of the almost square block of the Welsbach buildings were the ones which seriously suffered, and to them the fire was confined. The mantle factory, laboratory, and all else, but the stores, are intact. The stores overlook an open part of the District Railway; and during the time the fire was raging, all passenger traffic had to be stopped. At that hour of the morning, of course, this occasioned considerable inconvenience.

The outbreak occurred in the stores; but how, is a matter of complete mystery. The place was stocked with glass, gas-fittings, lamps, and pendants of numerous kinds covered with straw and stacked in wooden crates and bins; and, one or two of the floors being used for packing purposes, the whole of the wing was practically filled with inflammable material, which added immensely to the fierceness and brilliance of the fire during the hour or so that it lasted. But the rapidity with which the fire exhausted itself is shown by the fact that the floor on which it started is little more than charred. The outer part of the structure stood intact, excepting the windows; but the upper part of the building is severely damaged, and will need considerable reconstruction. It is true that it is estimated the damage will reach £20,000 (which is fully covered by insurance), but a large portion of this is apparently represented by the destruction of the valuable stock of glass, fittings, and pendants.

The Welsbach Company have to congratulate themselves on the wise prevision which separated their several departments on every floor by iron fire-proof doors. With such a fine seat for a fire as the stores presented, no one can tell where, without the iron doors, the conflagration would have ended; and to-day might, had things been otherwise, have found the Company's business without a centre, and in a terribly disorganized condition. But as it is business and work were proceeding on the premises within a few hours as though nothing whatever had happened. The prompt closing of the iron doors prevented draughts, stopped all open side channels for the fire, and so prevented the fire licking its way beyond the stores. Among the exaggerated statements was one that millions of mantles had been destroyed. Nothing of the kind happened. The mantle factory and departments are in another wing of the building altogether. As soon as the outbreak was discovered, the hundreds of girl workers in the factory were, as a precautionary measure, sent out in an orderly manner. But fortunately the exodus was only a temporary one. The factory has two large exits into York Street, quite away from the scene of the conflagration, so that there was no necessity for immediate alarm or undue haste. The statement in the Company's official report that not one of the thousand odd employees suffered by the fire, says something for the discipline which prevailed at the time; and that, within four hours after the fire, the auxiliary factory in Southwark Street was rendered available for packing and the execution of London orders, speaks of the heartiness with which the men worked to meet the emergency and relieve the strain of the day. As a matter of fact, there was nothing more than a passing interference with the Company's business; and it did not occasion any delay in fulfilling customers' requirements. Moreover, the Company had only just previously stocked their new trade distributing depôts in Manchester, Birmingham, and Glasgow with burners and mantles.

AN INQUIRY CIRCULAR FROM HALIFAX.

Attention has frequently been called in the pages of the "JOURNAL," to the trouble certain people in the gas profession seek to inflict upon their *confrères;* but in fairness to Mr. Holgate, of Halifax, one may, we think, acquit him of being personally desirous of raising the ire of his friends and acquaintances among our readers by circularizing them as he did recently by request of his Committee. One of the correspondents who sends the list of queries addressed to him on the 13th inst., says: "Notwithstanding the straight hints given in the "JOURNAL" on this business, some people still seem to think that they possess a monopoly of the time of others—to say nothing of the results of one's experience." For the benefit of those who were not "favoured" with Mr. Holgate's string of questions, we append same.

(1) Name of town. (2) Quantity of coal gas made per annum; quantity of carburetted water gas made per annum; total quantity of gas made per annum; total quantity of gas sold per annum (exclusive of used on works). (3) Illuminating power of gas; kind of burner used as standard; is gas tested by an independent person? (4) Length of mains. (5) Number of consumers (ordinary); ditto (prepayment). (6) Average net price of gas sold. (7) Average cost of coal per ton; cannel per ton; oil per gallon. (8) Average selling price of coke per ton. (9) Cost of making gas per 1000 cubic feet sold. (10) Gross profit per 1000 cubic feet sold. (11) Interest per 1000 cubic feet sold. (12) Renewal or reserve fund per 1000 cubic feet sold. (13) Sinking fund per 1000 cubic feet sold. (14) Net profit per 1000 cubic feet sold. (15) To what extent have you stoking machinery? (16) To what extent have you coke conveying and screening plant? (17) To what extent have you inclined retorts? (18) To what extent have you plant for making carburetted water gas? (19) Do you make sulphate of

ammonia? (20) Do you distil your tar? (21) Have you recently enlarged your works; if so, to what extent? (22) Have you recently purchased other gas undertakings in whole or part; if so, to what extent? (23) Have you a railway siding into your works? (24) Cost of gas-works; sulphate of ammonia plant; tar distillery; mains and services; meters; stoves; land or property not required for the gas undertaking; other items. (25) Total cost, less amount repaid. (26) Net capital. What has been your maximum daily make of gas? (27) What could you make as a maximum per day? (28) Average make of gas per ton of coal used. (29) Quantity of coal used, in tons; cannel used, in tons; oil used, in gallons. (30) The accounts are for the year ended ——.

And to cap all—which a correspondent regards as "quite a joke"—three days afterwards Mr. Holgate wrote: "I find that we omitted to ask, in the queries sent on the 14th inst., what is your average make per mouthpiece—*inclines and horizontals separately*.

THE PRICE OF GAS IN NORTH LONDON.

Proposed Gas Bill by the County Council.

At the last Meeting of the Common Council of the City of London, a communication was read from the London County Council, relative to the proposed deputation to the President of the Board of Trade from the Local Authorities represented at the conference convened by the Council, on March 7 last, on the subject of the price charged by the Gaslight and Coke Company in the districts north of the Thames, with a view to the Government either initiating or supporting legislation on the subject. Enclosed therein was a copy of the reply from the President of the Board of Trade, stating that "as he is not in a position to introduce legislation, he fears that a deputation would not at the present time serve any useful purpose." The Council asked whether the Corporation would be prepared to assist them in bringing a Bill on the subject before Parliament. The letter was referred to the Streets Committee for consideration and report.

BOLTON CORPORATION GAS SUPPLY.

The Past Year's Working.

The abstract of the accounts of the Gas Department of the Bolton Corporation has been issued. It is preceded by the annual report of the Gas and Lighting Committee, signed by the Chairman (Mr. J. Horrocks). This shows that 100,400 tons of coal were carbonized, at an average cost of 15s. 5d. per ton, in the past financial year, compared with 101,187 tons, at 14s. 6¾d. per ton, in the previous twelve months. The make of gas was 1,029,155,000 cubic feet, or at the rate of 10,250 cubic feet per ton, against 1,022,510,000 cubic feet, or 10,105 cubic feet per ton, before. The accounts show that the sale of gas produced a net sum of £125,374, compared with £117,232; residuals yielded £36,990, against £48,649; and the total revenue was £163,931, compared with £168,273. The expenditure on the manufacture of gas was £94,392, compared with £102,014; distribution cost £8546, against £7749; and the total expenses were £112,849, against £118,645. The balance carried to the profit and loss account is £51,082; whereas this time last year it was £49,628. The amount standing to the credit of the profit and loss account is £51,620; and it is accounted for as follows: Annuities, £5342; interest on loans and deposits, £5403; dividend on Corporation stocks, £12,587; sinking fund, £3159; bank commission, £30; and district fund account, £18,730—the balance of £6369 being transferred to the reserve fund account. The total net expenditure on the works at the close of the financial year was £666,788 13s. 1d.; being at the rate of £648 per million cubic feet of gas made, £6 12s. 10d. per ton of coal carbonized, and 13s. 8d. per 1000 cubic feet of gas sold.

THE NEW GAS MANAGER AT LLANELLY.

A chatty descriptive account of an interview which a representative of the "Llanelly Mercury" has had with Mr. T. Acland, the new Manager of the Llanelly Gas-Works, appears in a recent issue of that paper. Mr. Acland takes up his work at Llanelly with a very good record as a hard-working and painstaking Manager. He was formerly in charge of the Blaina Gas-Works; and on his departure from there he was elected a Director. The interviewer makes it clear that the recipient of that honour deserves it. During the time he was at Blaina, Mr. Acland virtually reconstructed the works; and he paid the shareholders during the last six years the maximum dividends. This had never been done before in the history of the Company. Of his workmen at Llanelly, the new Manager says he has no fault to find with them. They are doing their work to his entire satisfaction, and appear perfectly contented. He considers the price of gas is far too high. There was a reduction of 3d. per 1000 cubic feet in January last; and he wants to considerably reduce it again. He has two or three schemes on hand which he hopes will increase the output, and enable him to decrease the price. The works are equipped with plant sufficient to serve a town twice the size of Llanelly. He candidly confesses that the town is not well lighted; and he is hoping the District Council will enable him to show what gas can do. "My aim is," Mr. Acland told the representative in conclusion, "to give the shareholders a fair dividend, and the people of Llanelly cheap gas; and both can be done easily if the people will only assist." We wish Mr. Acland success.

The Geltsdale (Carlisle) Water Scheme.—The resolution of the Geltsdale Water Committee of the Carlisle Corporation on the subject of obtaining the services of Mr. James Mansergh to report upon the above-named scheme (*ante*, p. 1311) has been submitted to the Town Council, and unanimously adopted.

PRIMITIVA GAS AND ELECTRIC LIGHTING COMPANY OF BUENOS AYRES, LIMITED.

The First Annual General Meeting of this Company was held at the London Offices, No. 2, Bank Buildings, Prince's Street, E.C., on Tuesday, the 13th inst., under the presidency of Mr. H. E. Jones.

The Secretary (Mr. J. H. Bouwer) read the notice convening the meeting and the Auditors' certificate; and the report and accounts—to which reference has already been made in the "Journal," p. 1294—were taken as read.

The Chairman said that as this was the first meeting of the new Company in England, it was necessary for him to call attention to the reconstruction of the capital account. This corresponded very much with what was done now by all the leading English companies, so that the process would be familiar to most of those present. They would probably be aware that all the three large Gas Companies supplying the Metropolis (one of which he had the honour to assist in the administration of) had converted their 10 per cent. stock. In the case of two of them, £100 of this stock was changed into £250 of 4 per cent. stock. This was very much the same as had been done in regard to the Primitiva Company. They had also, however, to deal with the question of the reorganization of the management of the Company in Buenos Ayres; and for this purpose—looking to the necessity for developing all the modern facilities, which were so common to them now in England, but which were not adopted at Buenos Ayres a year ago—the Directors had thought fit to send out one of the most accomplished engineers of this country. He referred to Mr. G. W. Anderson, late of the Caterham Gas Company, and a son of Mr. George Anderson, who had for forty years played a most important part in the gas industry in both England and Ireland. That attention to the management was desirable, would be apparent to them when he mentioned that the Company twelve months ago were not assisting the consumers in the adoption of the Welsbach system. Incandescent lighting was, of course, accompanied by one little drawback; and he thought this to some extent explained the appearance of the accounts. If they gave a man a burner which furnished him with five times the light that he had before, he naturally expected to burn one-fifth of the gas he did previously. But they all felt that, in the long run, it was quite obvious that the man who was thus enabled to economize would increase the number of his lights; so that ultimately he would burn more gas, and would also be more contented with his supply than formerly. He thought this accounted for the fact that none of the Companies in Buenos Ayres had supplied an increased quantity of gas in the past year. The other Companies spoke of commercial depression and the number of uninhabited houses as explaining why there was not the usual advance; but he thought the introduction of the Welsbach burner had something to it with it. This, however, would only be for a time. Then, again, they felt that, as in the case of most cities enjoying rather a warm climate, there would be many uses for gas as a fuel, as compared with solid fuel, which lasted longer when once alight, and was more expensive, because they could not put it out the moment they dispensed with the necessity for the heat. His own experience with some French gas undertakings was that, where ordinary fuel was little employed and not much liked, gas was very useful, and was very rapidly developing. Another thing he might mention was that they had thought it desirable to rearrange their chemical works, which (though they were a source of great profit which was not enjoyed by either of the other Companies, who did not manufacture their own chemicals) were very much out of date. Plans for improving them had been passed; and the necessary plant was in hand. Further, they were at the present time able to effect many economies, one of which he might say at once would strike them by its importance in amount. Something like £3000 a year was expected to be saved in stoking expenses alone under the new management. Mr. Anderson clamoured by every post for certain labour-saving appliances, which had been considered and approved of by the Board, and would be sent out. He was also happy to say that they had been able to secure the larger proportion of their coals for the present year at a very great reduction on the figures in the accounts now before the shareholders; and they were arranging their freights at a considerable saving compared with what prevailed under the old management. He had therefore little fear that, when next he had the pleasure of addressing the proprietors, he would be able to point to a balance-sheet which, even if misfortune should prevent them selling more gas, would at any rate show a much smaller expenditure on revenue account, by reason of the improvements which were in progress. A revaluation had been made of the whole of the Company's property; and they would be gratified to learn that this had resulted in an increase of close upon £100,000. No advantage had, however, been taken in the accounts of this increase in value. The valuation was made for the purpose of reassuring the Directors with regard to the position of things; and the result was very satisfactory, though they had not based any profit upon it. It might be asked why the Directors had not recommended the payment of a dividend on the ordinary shares, seeing that there was a balance of £12,771 carried forward, which, roughly speaking, represented 3 per cent. The Board had felt that, in face of the present stagnation of business in Buenos Ayres, the empty houses mentioned by the Chairman of the River Plate Gas Company, and it being their first year of office, they ought not to do anything to encourage anticipations which might not be fully realized at the next meeting. They had therefore thought it best to keep this money as a nest-egg for the future. He was reminded by Mr. Kincaid that he had not said anything about the electric lighting portion of their business. This was an important omission, for some £300,000 of their capital was represented by a very efficient, and very profitable, electric lighting undertaking. The earnings of the electric light works separately would well justify a somewhat larger dividend than they had declared upon the whole undertaking. But this, again, was all with new plant which had been largely constructed within the last two years; and so they thought they would rather keep the money in hand than distribute any of it at present in dividend. The return, however, was very satisfactory; and though the sale of gas did not show any increase at all, electricity showed an increase of 8 per cent.

He could not conclude his remarks with regard to electric lighting, without saying that it was a matter of extreme gratification to him that they had Mr. Kincaid on the Board. Mr. Kincaid was at the very head of his profession; and his advice on electrical subjects was of the greatest value to the Company. He then formally moved the adoption of the report and accounts.

Mr. W. W. PHIPPS seconded the motion.

Mr. J. ANDOVER asked whether the electric lighting plant was driven by gas or steam.

The CHAIRMAN replied that it was driven by steam-engines; but they hoped the steam would be raised by means of gas coke. He would also like to point out that the Company would save a good deal of money by having only one staff for the two branches of their business.

Mr. ROBSON inquired what had become of the reserve funds, amounting to £50,000, which appeared in the accounts of the old Company.

The CHAIRMAN remarked that Mr. Touch was present, and he would ask him to answer that question.

Mr. TOUCH explained that the position was that the new Company acquired the assets of the old Company; and the reserve was a liability. The new Company, however, were not under any obligation to deal with the liabilities of the old Company; and so the item of reserve simply dropped out. The old Company had so much capital, and a reserve account, or anything they might call it; and this capital and the reserve account were represented by certain assets. The new Company purchased these assets, and they passed into their books; but they had nothing to do with any question of reserve. A company could not start with a reserve fund. It was quite impossible to earmark the reserve fund referred to, as it was not separately invested, but was used in the business.

The CHAIRMAN remarked that it was very much the custom, even in this country, to employ reserve funds as capital, rather than raise fresh capital or borrow money from the bankers. He could assure them that there was no sum in the reserve fund to be handed over to the new Company, or he should have told them all about it. As a matter of fact, the old Company had been rapidly extending their undertaking; and they found them very short of money—indeed, they had to help them, because all their money had gone in the purchase of the electric lighting plant and in paying for extensions. With regard to the present improvements, it was an important fact that Mr. Anderson had succeeded in making use in other ways of the smaller machinery which was no longer required for its original purpose owing to the introduction of the larger plant.

The resolution was carried unanimously; and the Auditors (Messrs. G. A. Touch and Co.) were afterwards re-appointed.

The proceedings then terminated.

MONTE VIDEO GAS COMPANY, LIMITED.

Annual Report and Accounts.

In the report which the Directors of the above-named Company will present at the ordinary general meeting next Thursday, they state that the profit on the working in the year ending Dec. 31, as shown by the revenue account, is £26,695, which has been passed to the credit of profit and loss. Adding interest and discount, Directors' fees waived, and the balance brought forward, the total is £29,510. After providing for interest on debentures, loss on exchange, income-tax, bad and doubtful debts, and for depreciation, the balance available for distribution is £25,963. An interim dividend was paid on the 23rd of November last, in respect of the half year ended the 30th of June, of 6s. per share, less income-tax; and the Board now recommend the payment of a further amount of 8s. per share (also less income-tax); making a dividend of 3½ per cent. for the year. This will absorb £18,967, and leave a balance of £6996 to be carried forward. The contingency account stands at £8603 18s. 10d. The balance at the credit of the reserve account, after deduction of the £31,400 applied in redemption of the debentures paid off up to and including those payable on Jan. 1, 1902, is £42,600; and the insurance fund remains at £12,500. The Company's operations throughout the past year were carried on with regularity, and the Directors have the satisfaction of reporting that, compared with the year 1900, the position of the Company has improved as follows: The number of meters in use increased by 6·04 per cent., and of consumers by 6·08 per cent.; the sales of gas augmented by 6·74 per cent.; the returns from the Dock Department showed a further improvement; and the net profit increased by £3587. The Government's old account for gas and fittings supplied to June, 1890, and standing in the balance-sheet at the original amount of £5611 12s. 6d., remains unliquidated. The whole of the plant and property of the Company has been efficiently maintained.

THE SUPPLY OF GAS-FITTINGS AT YEOVIL.

Municipal Trading Again.

At a Meeting of the Yeovil Town Council yesterday week, a letter was read from Messrs. H. B. & H. Petter, who carry on business in the town, expressing the hope that the Corporation, as proprietors of the gas-works, would not seek to deprive them of a valuable part of the business in which they were engaged, and in which they had considerable capital invested. They had no wish to interfere with that which they considered the legitimate business of a public gas-works—namely, the laying of service-pipes up to the meter, the sale or letting on hire of gas cooking-stoves, and the free fitting which is usual with prepayment meters. Any business outside these limits should, however, be left to those engaged in the gas-fitting trade in the town. It was true that the old Gas Company had done other business than that mentioned. But Messrs. Petter submitted that while this was unfair on the part of a company holding a monopoly of the gas supply, it would be much more so on the part of the Corporation; and that as the undertaking was financially successful, it should not engage, in opposition to the tradesmen of the town, in the sale of gas pendants and brackets, gas-fires, globes, chimneys, incandescent mantles, and the numberless requirements connected with gas illumination.

Mr. J. VINCENT, the Deputy-Mayor, denied that injustice was done to tradesmen by the action of the Corporation. It had been the custom of the Gas Company to sell gas-fittings, and the Corporation had bought this business, and having expended a certain amount of money in order to show the fixtures, stoves, &c., had carried it on satisfactorily. So far from it being an injustice to private traders to continue this business, he believed it would be an injustice to the town to give it up.

Alderman PITTARD remarked that in other towns that he knew the Corporation owning the gas-works showed gas-fittings in precisely the same way.

Mr C. J. HOOK said he was not one of those who believed in municipal trading; but seeing that the Gas Company had been engaged in this business, he did not see much to complain of in the Corporation continuing it. If the Corporation had started the business, he should have voted against its being continued.

Mr. W. BRADFORD understood that the Gas Committee had traded in coal and other things; and the question was, Where were they to draw the line?

Mr. W. COLE thought that if it was a fact that private people were supplied with a truck of coal at a reduced price, everyone should have the same privilege. It was currently reported that there were some people who were allowed to buy coal from the Gas Committee.

Mr. VINCENT said that, under certain circumstances, one or two people might have been served with a truck of coal; but it had certainly been very limited. The employees at the gas-works had always been allowed to have a truck or two, and there might have been one or two others. He had himself bought one truck from the Gas Committee; but anything like the Committee engaging in a coal business had never happened.

Mr. BRADFORD considered that everyone should be dealt with equally in this matter. Either the public should have the right of buying coal from the Gas Committee, or the supplying of a few individuals should be stopped.

Mr. VINCENT said he could not get coal from any of the firms in the town, and so he went to the gas-works. He paid a profit on the cost of the coal.

It was decided that a reply should be sent to Messrs. Petter, that no new business had been started at the gas works, and that the Corporation were simply continuing the practice of their predecessors.

GAS AFFAIRS AT GREENOCK.

The Alteration at the Works—The Quality of the Gas.

Bailie Campbell, as Convener of the Gas Committee of the Greenock Corporation, moved the adoption of the minutes of the Committee at last Tuesday's meeting. Before he did so, however, Mr. Mitchell, his predecessor in that office, asked for an explanation of the following paragraph: "The Clerk submitted letter from Messrs. West, of Manchester, stating that they would be glad if the Committee would arrange with Mr. Monteith, the interim Manager, to take down the whole of the retorts at the south end of the chimney as early as possible, and light up the low-level retorts at the north end of the chimney without delay." Bailie Campbell said prominence was given in the minutes to the quality of the gas supplied during the past month. For the first time they had three statements; and it would be seen that they differed very considerably. He was not prepared to say which of the three was the most veracious, but in the meantime their value was much discredited by the discrepancy between them. Very much depended on whether the testing apparatus used was in good order; and if they agreed to employ an expert to report upon the condition of their works, he thought they should get him to give attention not only to the manufacturing department, but to the distributing plant, because if there was any defect in the latter it would materially affect the results obtained. With regard to the matter referred to, Mr. Mitchell, in view of the urgency of proceeding with their scheme at Inchgreen, had put himself in communication with Mr. Monteith, and had found that it would not be possible to take down all the retorts; but he asked him to try to follow out the request of Messrs. West as far as possible. This was accordingly done. It had been agreed to recommend that the contract with Messrs. West should be remitted to the Gas-Works Sub-Committee; and they thought that, in view of the extreme importance of the scheme, it should be proceeded with under a formal contract, which might prove to be of much value as the work proceeded. Mr. Morrison, in seconding the motion, said it had been agreed that the Sub-Committee should be asked to report on the condition of the gasholders. One was certainly defective; but as there was some uncertainty as to the extent of the repairs required, it was proposed that the Sub-Committee should make an examination. Mr. Bennet said, with regard to the differences in testing the quality of the gas, the most remarkable feature of the matter was that, while the variation in the maximum reading was less than two candles, the variation in the minimum reading was about six. The Provost strongly discountenanced the giving of reports by three gentlemen as to the quality of the gas. They had a responsible official for the work, and they ought to see that he was provided with a proper instrument, and that only his report should be received by the Corporation. Mr. Lamont thought they should know what was the quality of the gas, not only in two parts of the town, but in more, because the main point for the consumers was what the illuminating power was inside their dwellings. Bailie Campbell closed the discussion by again referring to the impropriety of several persons taking upon themselves the testing of the gas, and the desirability of allowing one official to do the work—testing the gas at four or five different places in the town. Referring to the defective gasholder, he said it came from the old gas-works in Crawford Street; and he did not think it was at all to be wondered at that it should have developed some defects, but what he had found was of the most innocent character possible.

AWARD IN THE POULTON-LE-FYLDE ARBITRATION.

The award in this arbitration, which was held at the Surveyors' Institution early last month (*ante*, p. 969), has been given. The object, it may be remembered, was to determine the price to be paid by the Urban District Council of Poulton-le-Fylde to the local Gas Company for their undertaking, under the terms of the Act of last year. Mr. Thomas Newbigging was Arbitrator for the Company; Mr. W. A. Valon for the Council—Mr. Ernest Moon, K.C., being the Umpire. Under clause 5 of the Act, the Council were to pay to the Company such consideration as would represent the money expended on capital account in connection with the undertaking, together with "such additional sum of money as may be mutually agreed upon between the Company and the Council, or, in case of dispute, may be awarded by arbitration." Mr. H. E. Jones, for the Company, made the net value £33,729, to which he added 10 per cent. for compulsory sale; bringing the amount up to £37,101 (his figures for the net value being subsequently reduced to £30,270). Mr. S. Wood, of the firm of Messrs. Lass, Wood, and Drew, gave evidence in proof of figures supplied by the Company; and Mr. R. Porter, of Elland, made the net value £33,110. Mr. E. H. Stevenson, for the Council, made the value £12,305, saying the purchase clause in the Act did not contemplate that the arbitration should take place upon the usual basis of commercial value. As a sum of £8208 had been agreed upon as representing the expenditure on capital account (£10,008, less £1800 the amount of the original purchase-money), he put the "additional sum" at something over £4000. The award is £18,331, exclusive of the mortgage debt of £1800.

ELECTRIC LIGHTING NOTES.

A Deficit at Hull.

According to the annual financial statement of the Chairman of the Electric Lighting Committee of the Hull Corporation (Mr. Skinner), there has been expended on the undertaking £204,763 out of the £244,032 authorized. In the past twelve months, upwards of £20,000 was spent on mains. The Committee made a reduction in the charge for current of $\frac{1}{2}$d. per unit, anticipating a substantial decrease in the price of coal; but, owing to other causes, among them an advance in the rates, their estimated profit has been wiped out, and for the first time in the history of the undertaking they report a deficit in the revenue account. The gross receipts were £24,512, and the working expenditure £14,685; leaving a balance of £9827, which had to be supplemented by £2732 from the reserve fund to meet various charges amounting to £12,559. The number of consumers rose from 302 to 1843; and there were sold 1,490,099 units—being an increase of 183,024. There was, however, a decrease in the number of units sold per lamp from 13·9 to 11·4—the smallest, with one or two exceptions, recorded in any municipal electricity supply works.

The Past Year's Working at Birmingham.

The Electricity Supply Committee of the Birmingham City Council have issued their report, giving the financial results of the working of the department for the year ended the 31st of March last. They state that the units sold during this period, compared with the previous year, were as follows: Units sold in year ended March 31, 1902, 3,391,099, of the money value of £61,384 4s. 4d.; year ended March 31, 1901, 3,040,822 units, of the money value of £55,810 4s. 2d.—being an increase of 11·5 per cent. in the units sold, and 9·9 per cent. in the money value. The revenue account shows a gross profit of £18,514 2s. 9d.; but as the charges for interest and sinking fund amount to £23,327 2s. 3d., the net result is a deficiency of £4812 19s. 6d. This is due to the charge of £8731 11s. 6d. for the conversion of a portion of the system from 110 to 220 volts with which the revenue account has been debited. This sum, being of the nature of special expenditure, largely increasing the efficiency of the system, might not unreasonably have been charged against the renewal fund, in which case there would have been a gross profit of £27,245 14s. 3d., and a net profit (after providing for interest and sinking fund) of £3918 12s. The Committee, however, have followed the precedent of last year, which was approved by the Council, and have charged the total cost of the work against revenue, taking from the renewal fund only the deficit of £4812 19s. 6d.

Electricity Supply at Bolton.

The abstract of the accounts of the Electricity Department of the Bolton Corporation which has lately been issued by the Borough Treasurer (Mr. G. Swainson) shows signs of progress. Under the supervision of Mr. Arthur A. Day, the Electrical Engineer, the quantity of current generated in the year ending the 31st of March last was 3,825,761 units, of which 3,120,709 units were sold for private consumption and the working of tramways, against 2,937,171 units and 2,431,737 units respectively in the preceding twelve months. The gross revenue in the past year was £29,800, against £24,096 before—an increase of £5704; while on the expenditure side the cost of production in 1900-1 was £13,542, and during last year £12,480, a diminution of £1062. The gross profits have increased to £17,319 from £10,554 the previous year—an increase of £6765. Out of this sum, there have been paid in interest £4912 and depreciation £7655; leaving a balance of net profit of £4752, equal to 3 per cent. on the capital. A sum of £3850 has been voted to the relief of rates, and £902 is carried forward. Up to March 31, 1901, the capital expenditure had been £151,006, or equal to £62 1s. 11d. per 1000 units sold. At the close of the past year, the total outlay was £180,258, or at the rate of £57 15s. 6d. per 1000 units. The cost of production has decreased from 3·82d. per unit in 1895 to 0·96d. now; and a sum of £21,209 has been written off for depreciation of plant.

Kingston Undertaking.

The eighth annual report of the Electrical Engineer of Kingston (Mr. J. E. Edgcome), which was laid before the Town Council at their

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1408.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	Jan. 2	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	May 14	6½	Bombay, Ltd. . . .	6—6⅝*	..	5 0 0
40,000	5	,,	6½	Do. New, £4 paid	4¼—4¼*	..	5 9 5
380,000	Stk.	Feb. 13	12	Brentford Consolidated	255—260	..	4 12 4
270,000	,,	,,	9	Do. New . . .	188—193	..	4 13 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	128—133	..	3 15 2
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	112—115	..	3 9 7
220,000	Stk.	Mar. 13	10	Brighton & Hove Orig.	205—210	..	4 15 3
246,320	,,	,,	7	Do. A. Ord. Stk. .	148—153	..	4 11 6
420,000	20	Apl. 11	10	British.	40½—41½	+⅛	4 16 5
50,000	10	Feb. 13	12	Bromley, Ord. 10 p.c. .	23—25	..	4 16 0
82,850	10	,,	9	Do. 7 p.c. . . .	18—20	..	4 10 0
500,000	10	May 14	6	Buenos Ayres (New) Ltd.	9½—10¾*	..	5 14 3
220,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	94—97	..	4 2 6
150,000	20	Mar. 13	8½	Cagliari, Ltd. . . .	21—23	..	7 3 6
100,000	10	Sept 27	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	54—56	+1	5 7 2
550,000	Stk.	Apl. 11	12	Commercial Old Stock	267—272	..	4 8 3
236,425	,,	,,	9	Do. New do. .	205—210	..	4 5 9
238,237	,,	Dec. 13	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	,,	9	Continental Union, Ltd.	140—145	−5	6 4 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	155—160	..	4 7 6
575,000	Stk.	Feb. 27	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	122—127	..	3 18 9
486,090	10	Jan. 30	10½	European, Ltd. . . .	18½—19½	..	5 7 8
354,060	10	,,	10½	Do. £7 10s. paid	13½—14½	..	5 8 8
15,243,200	Stk.	Feb. 13	4⅛	Gas-light and Coke	4 p.c. Ord. . .	93—95	.. 4 12 7
2,600,000	,,	,,	3½		3½ p.c. max. .	88—90	−1 3 17 9
3,799,735	,,	,,	4		4 p.c. Con. Pref.	107—110	.. 3 12 9
4,193,975	,,	Dec. 13	3		3 p.c. Con. Deb.	90—92	.. 3 5 3
70,000	10	Nov. 13	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	May 14	10	Imperial Continental .	205—208*	..	4 16 2
473,600	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Feb. 27	10	Liverpool United A	215—217	−1½	4 12 2
718,100	,,	,,	7	Do. do. B .	166—168	..	4 3 4
306,083	,,	Dec. 30	4	Do. do. Deb. Stk.	118—120	..	3 6 8
75,000	5	Dec. 13	4	Malta & Medn., Ltd. .	4½—5	..	4 0 0
560,000	100	Apl. 1	5	Met. of	5 p.c. Deb.	106—110	+1 4 10 11
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	103—105	+2 4 5 9
541,920	20	Nov. 13	3½	Monte Video, Ltd. . .		9½—10½	.. 6 13 4
1,595,892	Stk.	Feb. 21	4⅜	Newc'tle & G'tesh'd Con.		106—107	−½ 4 1 9
346,855	Stk.	Dec. 27	3½	Do. 3½ p.c. Deb.		98—100	.. 3 10 0
150,000	5	Nov. 28	8	Oriental, Ltd. . . .		7¼—7⅜	.. 5 3 3
135,000	4½	,,	8	Do.		6½—7	.. 5 2 11
15,000	1	,,	8	Do.		1½—1⅝	.. 4 11 5
60,000	5	Mar. 13	7	Ottoman, Ltd. . . .		6⅛—6⅜	.. 5 3 8
				* Ex. div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
851,070	10	Apl. 25	7	River Plate Ord. . .	10—10⅛*	..	6 13 4
250,000	Stk.	Dec 30	4	Do. 4 p.c. Deb..	95—98	..	4 1 8
250,000	10	Mar. 26	8	San Paulo, Ltd.. . .	11½—12½	..	6 8 0
135,000	Stk.	Mar. 13	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	238—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	..	4 3 8
5,850,000	Stk.	Feb. 13	5	South Met., 4 p.c. Ord.	119—121	−1	4 2 8
1,627,965	,,	Jan. 16	3	Do. 3 p.c. Deb. . .	92—94	..	3 3 10
380,940	Stk.	May 14	5	Southampton Ord. . .	102—106*	..	4 14 4
70,825	,,	Jan. 16	4	Do. 4 p.c. Deb.	100—102	..	3 17 8
120,000	Stk.	Feb. 27	5½	Tottenham and Edmonton	A. 5 p.c.	120—125	.. 4 8 0
260,520	,,	,,	4		B. 3½ p.c.	95—100	.. 4 0 0
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	97—100	..	5 0 0
230,000	5	Mar. 13	9	West Ham, 10 p.c. . .	9—10	..	4 10 0
172,000	10	,,	6	Do. 7 p.c. . .	13—14	..	4 5 8
140,900	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	105—110	..	3 12 9
				WATER COMPANIES.			
780,599	Stk.	Dec. 30	11½	Chelsea, Ord. . .	305—315	..	3 13 0
150,000	,,	,,	5	Do. 5 p.c. Pref. .	155—160	..	3 2 6
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Mar. 26	4½	Do. 4½ p.c. Deb. .	140—145	..	3 2 1
1,720,560	Stk.	Mar. 26	8	East London, Ord.. .	208—213	+1	3 15 1
654,740	,,	Dec. 13	4½	Do. 4½ p.c. Deb. .	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb. .	96—98	..	3 1 3
700,000	50	Dec. 13	8	Grand Junction	10 p.c. max..	113—118	.. 3 7 10
310,000	Stk.	Mar. 26	4		4 p.c. Deb..	127—130	.. 3 1 7
708,000	Stk.	Feb. 13	16	Kent		295—305	.. 5 4 11
160,000	,,	,,	7	Do. New, 7 p.c. max..		200—210	.. 3 6 8
1,043,800	100	Dec. 30	10½	Lambeth, 10 p.c. max..		295—300	.. 3 10 0
406,200	100	,,	8	Do. 7½ p.c. max..		210—220	.. 3 12 9
350,000	Stk.	Mar. 26	4	Do. 4 p.c. Deb..		125—130	.. 3 1 7
500,000	100	Feb. 13	12⅞	New River, New Shares		405—415	.. 3 1 8
1,000,000	Stk.	Jan. 30	4	Do. 4 p.c. Deb..		127—132	.. 3 0 7
902,300	Stk.	Dec. 13	7	South-wark and Vauxhall	Ord. . . .	193—198	.. 3 10 8
126,500	100	,,	7		7½ p.c. max.	185—190	.. 3 13 8
489,200	Stk.	,,	5		5 p.c. Pref..	153—158	.. 3 3 3
1,019,585	,,	Apl. 11	4		4 p.c. A Deb.	125—130	.. 3 1 7
1,155,066	Stk.	Dec. 13	10	West Middlesex. . .		285—295	.. 3 7 9
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .		140—145	.. 3 2 1
200,000	,,	Mar. 13	3	Do. 3 p.c. Deb. .		95—97	.. 3 1 10
				* Ex. div.			

meeting last Tuesday, is not calculated to make the ratepayers particularly jubilant, though it bore evidence of improvement. True, there was an increase in the number of units sold in the past financial year from 308,860 to 346,332, and the average cost per unit was reduced from 3·29d. to 2·46d. The total works expenditure was reduced by £551 13s. 7d. (from £6387 17s. to £5836 3s. 5d.); whereas the total revenue increased from £6562 11s. 4d. to £7378 17s. 1d.—an addition of £816 5s. 9d. The profit on the works before payment of interest and repayment of capital rose from £174 14s. 4d. to £1542 13s. 8d. Interest increased from £1434 3s. 5d. to £1744 4s. 9d.; and the amount required for the repayment of capital from £1461 12s. 7d. to £2093 7s. 3d., though as yet, as Mr. Edgcome points out, a portion of this capital expenditure has not earned any revenue. The result of the year's working, after payment of interest and repayment of capital, is a debit balance of £2294 18s. 4d., against £2721 1s. 8d. the previous year. The number of consumers during the twelve months increased by 82, as compared with 65; and the number of 8-candle lamps connected by 3986, against 2769. A local paper says: "Though the electric light undertaking is proving somewhat of a burden to present ratepayers, its success in the future is assured. At the present rate of progress—if the expenditure on capital is not largely increased—the undertaking should in two or three years pay its way, and in a very few years more the profits should be sufficient to effect a substantial reduction in the rates." It is to be hoped that this prediction may be verified.

BRADFORD CORPORATION WATER SUPPLY.

The Nidd Scheme in Operation.

On Saturday, the 17th inst., the first instalment of the Nidd scheme for the supply of Bradford was brought into use by the delivery of water into the service reservoir at Chellow Heights. It is eleven years since the Corporation obtained parliamentary powers to intercept the head waters of the Nidd and a number of its tributaries, and carry out the necessary works for conveying them to Bradford; and a sum of about £1,500,000 has been expended upon them. The territory acquired lies directly north of the city, from which it is distant 30 to 35 miles, and is about 40 square miles in extent. There is a very sparse population, but a heavy rainfall—48 inches per annum; so that the locality is an excellent catchwater area. The scheme, which has been carried out by Mr. J. Watson, M.Inst.C.E., the Water Engineer of the Corporation, consists of two main parts—a conduit or aqueduct for catching and conveying to Bradford the water from 18,200 acres of land which lie more than 935 feet above sea level, and an immense reservoir in the bottom of the Nidd valley, 2½ miles above Pateley Bridge, to store the compensation water draining from 9900 acres which are below that level. This magnificent sheet of water, more than two miles long, is impounded by a dam of solid masonry thrown across the valley just below where stood the ancient and historic mansion called Gouthwaite Hall. It will be used for furnishing compensation to the millowners and others below. The water for Bradford and a number of other communities will be taken at a point about nine miles higher up the stream, where commences a channel which, following the contour of the hills, eventually, after a course of 33 miles, ends at Chellow Heights, close to Bradford.

According to an account of the works given in the "Yorkshire Daily Observer," this aqueduct, after leaving the little intake reservoir at Pry House, enters a tunnel 2421 yards long under Rain Stang, from which it emerges at Armathwaite Gill. Then, after running southward for six miles along the hillside overlooking Nidderdale, it is carried through the Burn tunnel, which is upwards of a mile long; and then almost immediately, bending in a south-westerly direction, it passes under Greenhow Hill in a tunnel which is longer than any railway tunnel in England, except that under the Severn. It is in the construction of this tunnel, 6204 yards long, that the most serious engineering difficulty has been experienced. It was originally intended to drive the tunnel from eight headings; and three shafts were accordingly sunk on the line—the middle (or No. 2) shaft being more than 400 feet deep. One day, however, an immense volume of water was tapped in the tunnel heading; and it ultimately filled the shaft to within about 100 feet of the top, so that it had to be abandoned. After emerging into Wharfedale, the conduit follows the hillside until just a little below Barden Tower, where it strikes across the valley, crossing the river between the Strid and Barden by a masonry bridge of three arches. Then, skirting Barden Moor and passing under the Midland Railway near Bolton Abbey Station, it continues past Chelker, and by a short tunnel under Silsden Moor comes into Airedale. Following the contour line above Howden Woods and passing close by Morton, it reaches the filter-beds at Gilstead, and then strikes across the Aire Valley, crossing the canal near Dowley Gap and the river a short distance below Cottingley Bridge, and so climbing up by Stony Ridge, reaches its termination at Chellow Heights, where a beautiful little service reservoir has been built to receive the water on its arrival. On the way, by means of branch conduits and intake weirs, the aqueduct picks up water from a number of streams. More than six miles of the entire length is tunnel, 14½ miles are cast-iron or steel pipes; and the rest is "cut and cover." Except where pipes are used, the internal dimensions of the conduit are 5ft. 6in. wide and 6ft. 3in. high; and the whole of it is built in solid concrete. Apart from the bridges and an occasional valve-chamber, there is very little to see of this great engineering work; but it is designed to convey 25 million gallons of water a day, or double the quantity hitherto available from the combined resources of the high, low, and intermediate levels of the water-works system.

It appears that next year Mr. Watson proposes to make a start with the construction of a reservoir at Angram, higher up than the intake at Pry House, but its completion will take another eight years at least, for it means the building of a masonry dam 1200 feet long and 140 feet high—the highest in England.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD.	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA.	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE.	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000

	Cubic Feet Daily.
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN.	1,000,000
PERNAMBUCO (Brazil)	125,000
MALTON	150,000
DULUTH, MINN. (Second Contract)	300,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.) 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. BROCKVILLE (ONT.) 250,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft.

PORTSMOUTH WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Thursday—Mr. W. GRANT, J.P., in the chair.

The Directors' report showed that the available balance on the profit and loss account was £25,015, out of which the Directors recommended the payment of the full statutory dividends. This, after deductions for void houses, &c., would leave a balance of about £8499 to be carried forward. During the half year ending the 31st of March, 3840 yards of additional service-mains were laid in new roads; making a total of about 51 miles of trunk-mains and 134 miles of service-mains. The number of additional services connected with the mains in the six months was 488; making the total number of premises under constant supply by the Company in all the districts, 41,655. The bulk of water pumped from Havant and Bedhampton was 1,378,804,000 gallons, or an average daily supply for all purposes of 7,575,8·0 gallons; being a decrease of 112,200 gallons daily, as compared with the corresponding period of last year. The quantity supplied for domestic use was equal to an average of about 29¾ gallons per diem per head of the population, exclusive of all supplies by meter. The Directors concluded by stating that they had, with the shareholders' approval, recognized the services of the Secretary (Mr. J. L. Wilkinson) by increasing his salary £50 per annum.

The CHAIRMAN, in moving the adoption of the report, congratulated the shareholders on the passing by the Board of Trade of the Company's Provisional Order for the increase of their capital, which would no doubt be confirmed by Parliament in July. The excellent business qualities of their Secretary had been recognized by an increase of salary. While they had put down additional street service-mains to the extent of 3840 yards, bringing the total to 134 miles of mains, their chief expenditure had been in connection with the laying of a separate 20-inch main for the use of the Admiralty establishments from the Company's high service reservoirs at Farlington to His Majesty's Dockyard. The great concession which they made to the town by basing the water rental on the assessment instead of on the rent, which two years ago involved a loss of revenue of £5000 per annum, had, he was pleased to say, now all been recovered but £287.

Lieut.-Col. LANYON OWEN seconded the motion.

The CHAIRMAN, in reply to questions, said the Directors had not lost sight of the matter of back dividends; but though they were carrying forward £8499, they had due to the bank on capital account £20,696 15s., and they hoped that with the fresh capital they would be enabled to pay some of the back dividends. In the Admiralty they had a very good customer, though some years ago certain economic gentlemen had reduced the Dockyard water bill by £2000 per annum; but with the increase of their national ships the consumption was now as large as or larger than ever, and the Company had recently secured very good terms indeed in regard to the laying of the new mains.

The report was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Some statistics are given this week of the make and output of gas from the Greenock Corporation Gas-Works. Dealing with the month of April, it is shown that the quantity of gas made was 20,436,400 cubic feet—an increase of 726,300 cubic feet as compared with April of last year—and that the average make per ton of coal was 9289 cubic feet. The quantity of gas sent out was 20,188,400 cubic feet, or an increase of 574,300 cubic feet. The coal used was 2200 tons, as compared with 2144 tons. Dealing with the ten months from July 1 to April 30 it is shown that the quantity of gas made was 288,750,400 cubic feet—an increase of 12,418,800 feet over the quantity in the corresponding period of last year; that the gas sent out was 288,623,400 cubic feet, an increase of 12,418,000 feet; and that the quantity of coal used was 29,761 tons, compared with 29,838 tons. These figures are interesting on account of the attention which is at present being directed to the condition of the Greenock Gas-Works. Of more general interest will be the figures relating to the illuminating power of the gas, as tested at three different places—at the works, at the meter-testing office, and at the town office. The figures are: Works, minimum 20 candles, maximum 24·65 candles, average 21·91 candles; testing office, minimum 14·20 candles, maximum 23·78 candles, average 19·05 candles; and town office, minimum 15·20 candles, maximum 22·75 candles, and average 18·55 candles. At the Committee meeting the discrepancies in these figures were remarked upon; and the suggestion was made that the tests should, as far as possible, be made under equal conditions, and by one expert tester. It was also proposed that tests should be made in dwelling-houses throughout the burgh. Regarding all this, it is pertinent to say that gas testing in Greenock already appears to have run mad, without its going farther. The proposal to send the gas tester into private houses is a step more removed from sanity than any which, so far as my recollection goes, has yet been made even in London; and it is therefore the most pronounced case of photo-rabies which has yet occurred.

The Gas Committee of the Dundee Corporation on Tuesday discussed the subject of the delay which took place in the completion of the new retort-house. The work, it was said, was about a year behind the contract time. The proposal was made that the penalty clause in the contract should be enforced, which would mean a sum of about £1500 in favour of the Corporation. It was explained that the delay was caused by the difficulty of getting a good foundation for the house. Borings showed dry sand; but the workmen found wet sand, which necessitated about double the amount of excavation, and the shoring up of the ground. It was remitted to a Committee, with powers to settle the balance of the contract price, and to arrange the amount of the penalty, if any.

The annual meetings of shareholders of gas companies are beginning to be held. On Friday of last week, the Fraserburgh Gas Company held theirs. A satisfactory statement of the year's transactions was

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read and approved. It was decided to pay a dividend of 10 per cent., and to carry forward a large balance to the reserve fund. It was also resolved to reduce the price of gas from 5s. per 1000 cubic feet to 4s. 7d., at which the charge for gas for heating has been for some time—thus making both charges alike. Two years ago the price of gas for lighting was 5s. 10d. per 1000 cubic feet. The annual meeting of the Stonehaven Gas Company was held on Monday. The balance-sheet showed a net profit of £739; and a dividend at the rate of 3s. per share was paid. The Chairman (Mr. T. Mitchell) stated that the balance-sheet showed an expansion both as regarded income and expenditure. Part of the increase in the consumption of gas (which amounted to 9 per cent.) was due to the number of cookers which were in use in the town. On account of the increased consumption during the past five years—which amounted to about 20 per cent.—the plant had been found to be too small for the requirements of the town. The Directors had therefore entered into contracts for the enlargement of the works. When those contracts had been completed, they thought they would be in a position to meet all requirements for the next thirty years, by which time he (the Chairman) imagined that some other illuminant might have taken the place of coal gas in Stonehaven. The money for the improvements would have to be borrowed; but he did not anticipate they would have any difficulty in doing this. Mr. D. Torry, in seconding the adoption of the report, said it might interest the shareholders and the general public to know that before they could put their works into a proper state of efficiency they would require to expend £5000. They would also need a new gasholder, which would cost about £2000; and they would have to obtain a site on which to place it. The report was unanimously adopted. The Newburgh Gas Company have paid a dividend of 2½ per cent. for the past year. The Aberfeldy Gas Company have declared a dividend of 4 per cent., and continued the price of gas at 7s. 6d. per 1000 cubic feet.

At a meeting of the Dundee branch of the Gas Workers and General Labourers' Union last week, it was reported that a great number of the labourers in the city were being paid only 16s. 6d. a week, which was not a living wage, and that the Town Council were paying their labourers in the gas-works ½d. per hour less than they had ordered contractors doing Corporation work to pay their men. This is regarded as an anomaly; and the clear remedy for it is, of course, to join the Union.

A very startling fatal accident occurred last Saturday at the generating station at Mannofield of the Aberdeen Corporation electric car undertaking. The station is to be lighted by gas; and workmen were fitting up the pipes, using ladders instead of scaffolding, to enable them to work in the ironwork of the roof. The employer (Mr. J. Brown), in the course of the work, rested the end of a gas-pipe upon a live wire, from which he received such a shock that he lost his balance and fell to the floor, a distance of about 25 feet. He sustained injuries of which he died shortly afterwards. The accident was, of course, a preventable one; but the reflection which is uppermost in connection with it is why, in a place where there is so much electricity, it should be arranged that the lighting should be by means of gas. Apparently electricians know which is the better light.

Yesterday afternoon the ceremony of cutting the first sod in connection with a scheme for the augmentation of the water supply of the town of Kilsyth was performed by Mrs. Wilson, the wife of the Provost of the burgh. The new reservoir, which was the particular portion of the work that was thus begun, will cover about 12 acres, and its capacity will be about 28 million gallons. The cost of the augmentation scheme is estimated at £10,000.

About half an inch of rain has fallen in Scotland this week, which is a sort of relief to many authorities who have charge of water supply undertakings. I note that the Edinburgh water supply is still declining. In the course of the past fortnight, the water in store decreased by nearly 63 million gallons. There is water in store which should last till about the end of October; but the vicissitudes of the seasons have to be taken into account in estimating whether the supply will hold out till then or not. The water supply of Falkirk is falling; and warnings have been issued against the undue use of water. The Corporation of Paisley have also issued a request to the community to be careful in their use of water, as there is a decrease in the quantity in store. At Port-Glasgow attention was called in the Town Council last week to the fact that the water in store is equal to a month's supply less than it was at the corresponding time last year.

Gas Explosion in a Bank at Hartlepool.—Last Friday, a gas explosion occurred at Messrs. Barclay's Bank at Hartlepool, resulting in injury to four persons. The branch cashier (Mr. T. H. Platt) had occasion to go to the strong-room, and when he opened the door a violent explosion resulted—the place having evidently been full of gas. Mr. Platt was severely burned about the head, face, and hands, and three other persons were injured. Practically no damage was done to the premises.

New Gadd and Mason Holder at Buxton.—A new gasholder on the Gadd and Mason system has been erected on the north side of the gas-works at Buxton. It is capable of holding 340,000 cubic feet of gas; but this quantity can be increased by the addition of another lift, making provision in all for 500,000 cubic feet. The excavation and foundation were undertaken by Messrs. Bradshaw and Clayton, of Buxton; and the ironwork was carried out by Messrs. R. Dempster and Sons, Limited, of Elland.

Sales of Stock and Shares.—At a recent sale at Barnsley, Messrs. Lancaster and Sons disposed of several lots of stock and shares in the Barnsley Gas Company. The 10 per cent. stock fetched £200 per £100 of stock; the "D" and "E" £10 shares, 7 per cent., £15 each; and the "G" £10 shares, 10 per cent., the same price. At a recent sale of £55 stock of the Barnard Castle Gas Company, the £10 lots fetched from £25 to £27 each, and a £15 lot sold for £39 10s.; the total amount realized being £144. The Company, which dates from 1834, has paid a dividend of 10 per cent. for the past 37 years; and the works are being largely extended.

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Why not Hire out the "EUREKA" and so increase your Gas Consumption?

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 24.

Sulphate of Ammonia.

Holidays have somewhat interfered with the business of the week; but the market has been firm at all points—the closing quotations f.o.b. Leith and Liverpool being £12 17s. 6d. to £12 18s. 9d. per ton. There has been more inquiry at Hull; but there is a dearth of supply at that port, and the quotation is nominally £12 12s. 6d. per ton f.o.b. Continental demand has fallen off, nitrate of soda there being now relatively the cheaper article; but the demand for Spain is well sustained, and there are large Colonial inquiries on the market which have not yet been covered. Interest in the forward position is maintained; and £12 2s. 6d. per ton, London, Beckton terms, July-September delivery, is reported to have been paid. Up to £11 17s. 6d. per ton, ordinary terms, has been paid f.o.b. Leith, for October March delivery, and more money is now required.

Nitrate of Soda.

This is quiet in all positions; and the closing spot price is 9s. 1½d. per cwt. for fine quality.

Tar Products. LONDON, *May* 24.

The market is generally quiet, doubtless owing to the Whitsuntide holidays. The demand for pitch, however, continues strong, and very high prices have been paid for local consumption, while the inquiries for forward delivery are still very good. The demand appears to have improved in the South Wales district, where patent fuel shows signs of advancing. Benzol is very dull. There is an absence of business; but prices remain unchanged. In solvent, business has been done in fine qualities, but at low prices for home consumption, while toluol appears neglected. Creosote is still weak in the North; but should the depression continue, the larger makers will burn the oil, as they reckon it to be worth from 1⅛d. to 1¼d. as fuel. In London, prices remain the same; manufacturers not being anxious to sell. As regards anthracene, there is no business to report. At existing prices, the article does not seem to interest either buyers or sellers.

The average prices during the week were: Tar, 16s. 6d. to 21s. Pitch, London, 43s. 6d. to 44s.; east coast, 42s. to 42s. 6d.; west coast, 38s. to 38s. 6d. Benzol, 90 per cent., 8½d.; 50-90 per cent., 7½d. Toluol, 9d Crude naphtha, 3d.; solvent naphtha, 9d. to 9½d.; heavy naphtha, 9d. to 10d. Creosote, London, 1¼d.; North, 1d. Heavy oils, 1⅛d. Carbolic acid, 60 per cent., 1s. 11d. Naphthalene, 35s. to 50s.; salts, 21s. 6d. to 25s. Anthracene, "A," 1½d. to 1⅝d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market continues very firm, and prices are advancing; the demand for prompt delivery being very strong indeed. The Gaslight and Coke Company are practically out of the market for early delivery; but the value may be taken as from £12 15s. to £12 17s. 6d., May-June, at which prices one of the large London Gas Companies have done business. For July-September, the nominal quotation is £12 5s. for Beckton; but the Gaslight and Coke Company do not appear to be sellers at this price. For October-March, £11 17s. 6d. would be accepted; but consumers have not yet paid this figure even for the Beckton make. Business in Leith continues very strong; but prices remain about the same—£12 15s. having been again paid for early delivery, while business is reported for forward delivery at full prices, the actual figures not having transpired. Hull is quiet. Business has been done at from £12 10s. to £12 15s., according to make and date of shipment. In Liverpool, prices are very firm, and some extraordinary figures are reported to have been paid for prompt delivery.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Not much business has been doing during the past week in the coal trade here; collieries in most of the important Lancashire mining centres having been stopped over periods of from three to six days (those in the Manchester district not resuming operations until to-day), while customers as a rule had already bought in such supplies as they required to carry them over the holidays. Under these circumstances the position presents few features calling for comment. For house-fire qualities there is a firm tone as to prices. With regard to steam and forge coals, there is a moderately steady tone at about late rates. Requirements for the better qualities of engine fuel have been in some instances rather in excess of the supply; and prices are strong on the basis of recent quotations. Common slack is not in so satisfactory a position as the better sorts; but for the moment at any rate, there is not quite such keen cutting in prices as has been noticeable of late. With regard to gas coal and locomotive fuel contracts, no new development can be reported; and the prices quoted last week may be taken as representing almost the average basis on which contracts have so far been settled. For shipment, one or two fair contracts have been secured recently; but prices show little or no improvement. At the pit, average quotations are about 13s. 6d. to 14s per ton for best Wigan Arley, 12s. to 12s. 6d. for Pemberton four-feet and seconds Arley, 9s. 6d. to 10s. for common house coal, 8s. 6d. for steam and forge coal, 4s. 6d. to 5s. for common, and 6s. 6d. to 7s. for the better qualities of slack. Steam coal ranges from 9s. 6d. to 10s. and 10s. 3d. per ton, according to quality, delivered at the Mersey ports. Best Lancashire foundry coke is steady at about 22s. to 24s. per ton, and common furnace coke at 13s. 6d. to 14s.; while best Yorkshire furnace coke is quoted at 13s. 6d., and common at 11s. 6d. to 12s. per ton at the ovens.

Northern Coal Trade.

Though the demand for coals is steady for the best kinds, it is not very full generally; and the limited tonnage in the river has on one or two days influenced the price. Best Northumbrian steam coals are

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PREVENTS NAPHTHALENE DEPOSITS.
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quoted from 11s. to 11s. 3d. per ton f.o.b., second-class steams are rather dull at from 9s. 9d. to 10s. 3d., and there is a good demand for steam smalls at 5s. 6d. to 5s. 9d. In the Durham coal trade, supplies are abundant; and prices are on the whole easier. In the gas coal trade, the local demand shows the falling off that is usual so near midsummer; and the price of Durham gas coals varies from 8s. 4d. to 9s. 3d. per ton f.o.b., according to quality. Some contracts for local companies on the Tees are now being arranged; and it is probable that they will be substantially on the terms of those for a Tyneside Company last named. Little gas coal is now being sold beyond contracts. In the coke trade, best export coke is 17s. per ton f.o.b., blast-furnace coke is 15s. 3d. to 15s. 6d. free at the Teesside furnaces, while the irregularity in the price of gas coke is not yet removed, though the production is now nearly at its lowest point.

Scotch Coal Trade.

The first blush of the Baltic trade having passed, there is a slackening of demand all round, fresh orders not coming in so freely as was expected. The home demand is a little more hopeful, in anticipation of improved trade when South African requirements come to be met. The quotations are: Main 8s. 3d. to 8s. 6d. per ton f.o.b. Glasgow, ell 9s. 3d. to 10s. 3d., and splint 9s. 3d. to 9s. 6d., which is much the same as in the previous week. The shipments for the week were 233,276 tons—an increase of 5565 tons upon the preceding week, and of 17,158 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,614,317 tons—an increase of 316,920 tons upon the same period of last year.

Reductions in Price.—The Gas Committee of the Bolton Corporation have decided to reduce the price of gas from 2s. 8d. to 2s. 6d. per 1000 cubic feet on and after the 1st of July. The Chorley Corporation have decided to reduce the price of gas to ordinary consumers by 3d. per 1000 cubic feet; also to abolish meter-rents and allow compensation to private owners of gas-meters, and, further, to reduce the price of gas to automatic meter consumers by means of a discount. The Meltham District Council have reduced the price of gas for lighting purposes from 3s. 4d. to 3s. 3d., and altered the charge for cooking purposes to 2s. 11d. with meter-rents and 3s. 3d. without.

Uckfield Gas Company.—The annual meeting of this Company was held last Thursday afternoon, when the report presented showed that the receipts amounted to £1306, against £1295 in the preceding year. The outlay for coals was £736, against £921. The Directors were therefore able to reduce the price of gas to 4s. 9d. per 1000 cubic feet at Midsummer last. The reserve fund, with the amount added last year, stands at £500, which has been appropriated in reduction of the debenture loan. The assets and liabilities account showed a balance of £845. The Directors recommended that £100 should be carried to the reserve fund, and that a dividend of 8s. per share should be declared. This would absorb £452, and leave £393 to be carried forward. The report was adopted.

Experiments with Southport Gas.—Experiments are at present being carried out to determine which is the best enricher for gas—benzol, oil, or carburetted water gas. The matter was fully discussed at a protracted sitting of the Sub-Committee of the Gas Committee last Friday. It is hoped that the result will be a considerable saving to the Gas Department.

Astwood Bank Water Supply.—At Astwood Bank, last Friday, Major F. H. Tulloch, M.Inst.C.E., conducted an inquiry, on behalf of the Local Government Board, respecting an application by the Feckenham Rural District Council for sanction to borrow £2850 for works of water supply for Astwood Bank. Mr. S. A. Gothard appeared on behalf of the Council, and explained that it was proposed to obtain water from the East Worcestershire Water Company.

Subways in the City Streets—The City Engineer (Mr. D. J. Ross, M.Inst.C.E.), in a report to the Corporation on the subject of the works executed during last year by the Public Health Department, states that beneath the City streets there are 1½ miles of subways under the control of the Corporation, but there are other subways not so controlled. The lengths of gas, water, telegraph, and other tubes, laid in the corporate subways extend over 11 miles; being an increase of three miles during the year. The Inspector of Subways reports that 15,335 workmen and others were admitted during the year for various purposes.

Exhibitions.—In connection with an exhibition of gas stoves, &c., recently held in the Wellington Town Hall, free cookery lectures were given by Mrs. E. A. Springthorpe, Principal of the North London School of Cookery. A number of "Metropolitan" gas kitcheners, manufactured by the Davis Gas-Stove Company, were exhibited by the Wellington Gas Company, and to interested audiences Mrs. Springthorpe showed the usefulness of the gas-stove in the home. The exhibition was opened by Mr. Harry Shepard, the Chairman of the Gas Company. Messrs. R. & A. Main exhibited at Cupar last week, with Miss Terrace as lecturer. Messrs. Parkinson and W. & B. Cowan, Limited, exhibited at Coupar-Angus, with lectures by Miss Vean.

Leeds Gas Workers' Wages.—At a special meeting of the Gas Committee of the Leeds Corporation, held on Friday under the presidency of Alderman Lowden, the application for an advance of wages to certain classes of workmen employed in the Corporation Gas Department again came up for consideration. In a recent communication, the Secretary of the Gas Workers' Union, writing on behalf of the men, offered to accept an advance of 4d. per shift under the proposed new conditions, or 3d. per shift under the conditions at present in existence. After discussing the question at length, the Committee came to the conclusion that putting into force new rules would entail disadvantages without adequate compensation in other directions, and therefore decided to offer an advance of 2d. per shift to the men under the existing conditions. It may be hoped that this offer will lead to a final settlement of what has proved to be a long-standing dispute.

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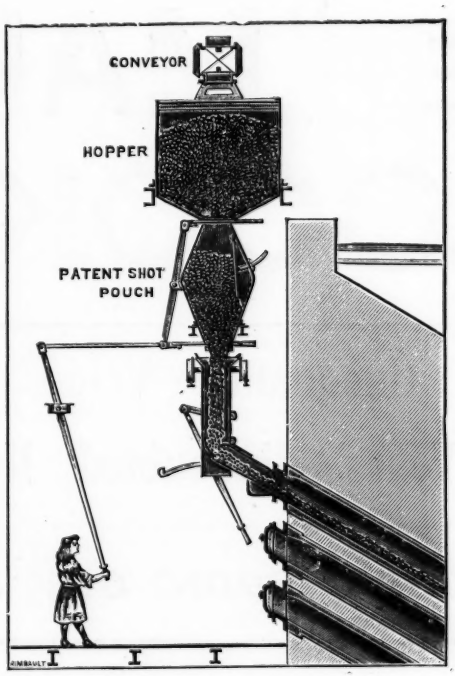

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Leigh and the Hindley Water-Works.—At the last meeting of the Leigh Town Council, it was unanimously resolved to approve the following recommendation of the Gas and Water Committee: "(1) That the Town Clerk be instructed to inquire whether the Urban District Council of Hindley were prepared to sell to the Corporation their interest in the joint water undertaking established under the Leigh and Hindley Local Boards (Water) Act, 1876, and, if so, on what terms; (2) that the Town Clerk be instructed to ascertain from Mr. J. Parry, Water Engineer to the Corporation of Liverpool, whether he is at liberty to advise the Council on the improvement of the water supply of the borough; and (3) that the replies be referred to the Water Supply Sub-Committee to take such action thereon as they may deem advisable."

Proposed Water-Works for Coggeshall.—At a recent special meeting of the Coggeshall Parish Council, Messrs. Parry, Ross, and Richards (London), and Messrs. Sands and Walker (Nottingham), submitted schemes for supplying the place with water. The London firm said that 60,000 gallons of water would be sufficient; and they proposed a site on the Colne Road for the boring, and for the erection of a reservoir holding about 200,000 gallons. They estimated the cost of boring, erecting buildings, &c., at £5705, and stated that a rate of 1s. 9d. in the pound would cover all expenses at the works. The Nottingham firm proposed two sites for boring, with the reservoir up the Colne Road, and to sink a 7½ inch borehole into the chalk at a depth of about 350 feet. This scheme is estimated to provide a supply of 20 gallons per head of the population, which would equal 54,600 gallons per day. The cost is given at £4952, and it was thought a rate of 1s. 7d. in the pound would be sufficient. It was decided to call a public meeting of the inhabitants, and, in the meanwhile, to leave the two schemes open for their inspection.

Luton Public Lighting.—The contract of the Luton Corporation with the Luton Gas Company for the last financial year was at 2s. 7d. per 1000 cubic feet, and 26 new lamps were erected, making a total of 677. Electric light takes the place of gas in 22 lamps. The cost of street lighting during the year was £1885, against £1608 for the year 1900; showing an increase of £277. This does not include wages for lighting, cleaning, and extinguishing the lamps, which amount to £346 6s. 2d. The cost of street lighting by gas is £2231; do. by 10 arc lamps for about six months, £101 18s.—total cost, £2332 18s. Of the large lamps, 43 are charged for by the Gas Company as ordinary single-burner "long light" lamps, the extra quantity of gas consumed being supplied gratis to the Corporation. Twelve large burners have been altered to the incandescent system. It appears, from a statement prepared by the Engineer and Secretary of the Company (Mr. W. R. Phillips), that they have not charged for the extra gas consumed beyond one mantle in the 43 large lamps, which amounts to 891,793 cubic feet, and at 2s. 7d. per 1000 cubic feet would be £115. There is also the cost of mantles and chimney bulbs, &c., not charged—viz., mantles, 3302; bulbs, &c., 1574—which, with the cost of fixing, amounts to £111; making a total of £226.

Shortage of Gas in Stockholm.—Owing to a general strike in Stockholm, on a demand for universal suffrage, the city was the week before last threatened with three days of darkness. According to the correspondent of the "Daily Express" in that city, the Gas Company issued a notice stating that they could not guarantee to supply gas to their customers during this period, their employees having joined the strikers. At the time of the dispatch, the street-lamps only were alight; in the houses candles and oil-lamps were being used.

Free Labour Association.—The twelfth annual meeting of this Association was recently held at Southampton—Mr. P. M. Stewart, J.P., presiding. The report of the Hon. Secretaries (Messrs. T. Morgan and W. Johnson) showed that the work of the various benefit funds had been maintained with increased interest during the past year. The accident and sea-going sick fund received £85 9s. 4d. in contributions from the members—an increase of £4 14s. 8d. There were 57 claims for benefit, which were met by the payment of £103 13s. 4d.—an increase of £8 4s. 2d. above 1900. In the savings bank there were 179 deposits, and there had been 48 withdrawals; being an increase of 86 and 9 respectively. The annual sick benefit club received from the members £103 17s. 5d., and £58 6s. was paid out in benefit; the surplus at the end of the year allowing a dividend of 7s. 3d. to each full member. The total benefits paid through the various funds since the Association started in 1890 had been upwards of £1932; the claims numbering 1177. These funds are not a compulsory condition of membership of the Association; it being left optional for members to join them or not. The report was adopted. Mr. S. W. Durkin, Engineer and Manager of the Southampton Gas Company, was elected a member of the Employers' Committee for the current year.

Fatal Accident at the Langley Mill Gas-Works.—Last Tuesday an inquiry was held into the death of Joseph Mousley, who was killed on the previous Saturday while following his employment as a labourer at the Langley Mill Gas-Works. William Prince, foreman at the works, said that on Saturday morning he was working with deceased. Two full trucks were being pushed up into the retort-house, and witness told deceased to keep clear. Witness then walked into the shed to watch the trucks, and heard a shout. He saw the last waggon bump against something. Witness dropped the brake on the second waggon, and saw deceased lying on the rail about two yards from the entrance to the sheds. Walter Truman said he saw the accident. He was just outside the shed. Deceased stood on the platform at the side of the line when the trucks came along. He got hold of the brake with both hands, and was forcing it down, when his left leg went down, and he stumbled in front of the first waggon on his face. Mr. John Andrews, the Gas Manager, said the men were all cautioned against putting down a brake from the platform. The trucks were not going too fast; and he could not imagine what gave Mousley the impulse to put down the brake. Deceased was used to putting on the brakes, and knew the right place to do it. The Jury returned a verdict of "Accidental death;" no blame being attached to anyone.

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A Water Diviner at Fault.—At the meeting of the Sleaford Rural District Council last Tuesday, it was reported that although they had bored to a depth of 420 feet at Billinghay, on the site selected by a well-known water diviner, who predicted that at a less depth than 300 feet they would tap a spring yielding 30,000 gallons per day, they had not reached water, nor was it thought that any could be obtained at Billinghay by boring. The Chairman (Mr. R. Burrows) said the Council sympathized with Billinghay residents in having thus spent £200 without result.

Gas-Meter Testing in Manchester.—The annual report of the Inspector of the Manchester City Justices' Gas-Meter Testing Committee which has been adopted by the justices, shows that during the year covered by it 36,203 meters were tested – an increase of 1099 compared with the previous year. The fees amounted to £1114; the profits earned being £83. The Inspector mentions that for 33 years, from 1862 to 1895, there was an average debit balance of £273; but as a consequence of the greater number of meters each year, the department in the last five years had earned a total profit of £451, in addition to providing nine new standard test holders, and all the necessary appliances, out of revenue. Of the 12,298 wet meters tested, 182, or 1·48 per cent., were rejected; and of the 23,905 dry meters, there were rejected 408, or 1·7 per cent. Satisfaction is expressed at the adoption by the Gas Committee of the suggestion of the Justices' Committee on the question of gas-meter index testing; and it is expected that the double test will be applied on and after the 1st of July next.

Sale of the Osmium Lamp Patents.—The heavy decline in the dividends paid during the past few years by the German Incandescent Gas-Light Company is now apparently beginning to reflect itself in the position of the Austrian Incandescent Gas-Light Company of Vienna, whose net profits for the year 1901-2 amount to 1,280,000 kronen, compared with 1,820,000 kronen in the preceding year. Nevertheless, the dividend amounts to the highly satisfactory figure of 40 per cent., as against 55 per cent.; but the considerable diminution recalls the similar decline which preceded the gradual set-back of the German Company a few years ago. The Austrian Company, which some time ago made for itself an excellent bargain with the German Company in relation to the patent rights of the osmium electric lamp for the Fatherland, has now disposed of half of the patent rights of the same invention to the French Incandescent Gas-Light Company, of Paris, for £40,000 in regard to France, Spain, and Italy. The proceeds of the transaction have apparently been devoted to the writing down of the value of the patent account. As far as the manufacture of the lamp is concerned, the Austrian Company states that, in consequence of technical difficulties, it has not yet reached the desired extent, though nothing now stands in the way of its construction on a large scale. On the other hand, the German Company have not met with any greater measure of success with this type of lamp. They expected to place the lamp on the market early last winter; but, so far, it has not made its appearance, notwithstanding experimental working over a period of about eighteen months.

The Provincial Incandescent Fittings Company, Limited, has been registered with a capital of £2000 in £1 shares, to adopt and carry into effect an agreement under which the Company will acquire the business now carried on by Rose Webber, Phineas Webber, and Lazarus Stein as the Provincial Gas-Fittings Company, in Manchester, Liverpool, and Leeds, with the assets thereof; to carry on business as makers, importers of, and agents for incandescent mantles, burners, fittings, and all accessories connected with incandescent lighting; and, in particular, to construct buildings, works, plant, machinery, and appliances required for their manufacture or storage.

Municipalization at a Loss at Brighouse.—There have recently been presented to the Brighouse Corporation, in Committee, reports relating to the financial results of the working of the gas, electricity, and water departments during the year ended the 31st of March. The revenue account in connection with the gas undertaking shows a deficiency of £1565 13s. 6d. It is noted, however, that the cost of gas supplied to public lamps, at the selling price of 2s. 9d. per 1000 cubic feet, amounts to £2531 18s. 6d.; and this, it is contended, should be properly charged to the Highways Department. The small electricity works continue to be in almost every sense unsatisfactory. On the year's working there was a loss of £62 17s. 6d., to which must be added £200, the amount of debt repaid, and £95 interest; making a total deficiency for the year of £357 17s. 6d. The revenue account of the Water Department shows a deficiency of £308 4s., though the real result of the year's working has been a profit of £394 12s. 5d. This difference is accounted for by the fact that to make the payments to the Halifax Corporation cover the same period as the water-rental, there is in this year's expenditure the charge for five quarters' water.

Gas Profits at Nelson.—A serious reduction has taken place in the profits accruing from the gas undertaking of the Nelson Corporation; and the Chairman of the Gas Committee (Alderman Wilkinson) gave an explanation of the causes to the members of the Town Council at their last meeting. In moving the confirmation of the minutes, he said that when the estimates were prepared they knew it would be necessary to pay for coal in advance. They, however, did not anticipate the cost would be so high as it had gone. The former Manager was at that time sanguine that with a large stock of coal, and in view of the fact that residuals were selling freely and at good prices, he could do without raising the charge for gas, and still make the profit they had done in previous years. Things had, however, not turned out as expected. Coal was advanced 2s. 11d. per ton, and they spent £1395 more than when it was at the old figure. They had not made so much gas as was anticipated, and the loss between the estimate and the actual realization was £1270. Then there was a further loss of £1129 owing to the lower price that they had been obliged to take for coke. He, however, would not admit that there had been any bad management. Mr. Reed, in seconding the motion, said he could not take such a rosy view of the situation as the Chairman. He could not get away from the fact that the late Manager had made a very poor estimate; and therefore he could not free him from blame. The minutes were passed.

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Heywood and Middleton Water Supply.—The members of the Heywood and Middleton Corporations, on the invitation of the Joint Water Board, recently visited the new works in progress at Ashworth Moor for the construction of a reservoir. Mr. James Diggle, Assoc.M.Inst.C.E., the Engineer, explained the scheme. When finished, it will have 62 acres of water space, and will hold 350 million gallons, or equal to the holding capacity of the Board's three reservoirs at Nayden and the one at Clay Lane. The estimated cost is £161,000, and to the end of March this year £35,554 had been expended. The Board supply a population of 62,000; and at the present rate of increase it is calculated that the reservoir will meet the requirements of the next 25 years.

Corrosion of Water-Pipes at Cardiff.—The Water-Works Committee of the Cardiff Corporation have been considering the water supply question from a scientific point of view. The cast-iron pipes, it appears, are subject to incrustation; and the service-pipes are liable to become corroded. This fact has been brought under the notice of the Committee by Mr. C. H. Priestley, the Water-Works Engineer, and Dr. Percy Frankland was engaged to report with him upon the matter. He suggested that certain experiments should be carried out, though he would not guarantee that they would be effective in their application to the Cardiff water. The Committee, after considering the matter, decided that they could not take any further steps at present. It is estimated that to treat the water in the way suggested by Dr. Frankland would cost between £2000 and £3000.

Gas-Workers' Union.—The biennial conference of the Union was opened in Manchester on Monday last week, under the chairmanship of Mr. Pete Curran, the General Organizer. From the annual report, which was submitted by Mr. W. Thorne, the General Secretary, it appeared that the progress of the Union was such as to give satisfaction to all ranks of its members. The contributions paid in the past two years amounted to £45,803, miscellaneous receipts to £602, and the income from the General Federation of Trade Unions to £1997; making a total income of £48,403. The total amount of dispute pay disbursed during this period was £14,742; including grants to other Unions of £221 and £7569 paid to the General Federation. The amount recovered by way of compensation for injuries and in wages was £8525. The number of branches, which in 1899 numbered 293, had increased to 342, with a membership of 46,014, and a financial membership of 37,415. The Union had dealt with 230 disputes, towards the expense of which 25,691 payments were made. The report concluded with the statement that while the members of the Union were anxious to avoid strikes, they were convinced that any decrease in their number was determined by the state of the organization of the workers and their preparation to resort to them should occasion arise. Mr. J. R. Clynes, District Secretary for Lancashire, reported that the membership in his district had increased from 5000 to 6000, while the district fund had grown in two years from £300 to £1160. They had paid to the Central National Fund £3223, and received from it in dispute pay £1982. The income for the district from all the branches was £4861, showing an increase of nearly £2000 on the income for the two previous years.

Huddersfield Gas Supply.—At the meeting of the Huddersfield Town Council last Wednesday, it was reported that the revenue on the gas-works accounts for the year ended the 31st of March was £94,061, after allowing £14,826 for interest and sinking fund. The expenditure amounted to £86,953; and the surplus was £7107. A sum of £3473, equal to a rate of 2d. in the pound, had been transferred to the relief of the borough rate for the current financial year, and the surplus applied in the reduction of the reconstruction account. The sale of coke and residuals had decreased by £6000, and the cost of coal increased by £3000.

Douglas (Isle of Man) Water Supply.—A few days ago, the members of the Douglas Town Council paid a visit to the new water-works which are being carried out by Mr. F. Thorpe. It appears that the Baldwin reservoir is now nearing completion, and it is expected to revolutionize the Douglas water supply. Its estimated cost is £50,000; and it is not anticipated that it will be exceeded by more than £5000. For this sum, the Douglas ratepayers will get a reservoir to hold 300 million gallons. The natural situation has had most to do with the extras; but much credit yet rests with Mr. Thorpe for the manner in which he has planned the work to the best advantage.

Newton-in-Makerfield Gas and Water Works.—Colonel Smith, R.E., held a Local Government Board inquiry at Earlestown Town Hall last Wednesday, in relation to the application of the Newton-in-Makerfield Urban District Council to borrow £10,433 for gas-works purposes and £821 for water-works extensions. The former item included a sum of £4067 which had been expended out of revenue during the five years ending March 31, 1901, and for which the Local Government Board had previously declined to grant borrowing powers. It was stated by the Clerk to the Council (Mr. C. Cole) that, unless the loan was granted, the amount would have to fall on the gas consumers, and this would mean a rather heavy increased gas-rate.

Lambeth Water-Works Company.—The report of the Directors of the Company for the half year ended March 31 shows that during this period 1724 houses and other supplies of water, estimated to yield an annual rental of £4115 3s., were connected with the Company's works, against 1781 houses, &c., producing a rental of £4197, in the corresponding six months of 1900-1. The revenue account exhibits an increase of £6286 in the water-rents, &c., and of £7797 in the expenditure. The surplus transferred to dividend and interest account is £80,612. There is to the credit of the latter account, after payment of interest on debenture stock, an available balance of £79,395. The Directors recommend that dividends at the prescribed rates of 10 and 7½ per cent. per annum respectively be paid on the £10 and £7 10s. per cent. stock, together with a payment on both descriptions of stock of 10s. per cent. (being at the rate of 1 per cent. per annum) on account of deficiencies of previous dividends. A balance of £2114 will remain to be carried forward, after making provision for the payment to the Chamberlain of the City of London, under the sinking fund clause of the Company's Act of 1886, in respect of debenture stock issued under that Act.

JOSEPH AIRD
GREAT-BRIDGE.
STAFFORDSHIRE.
TUBES
AND FITTINGS.
LONDON OFFICES: 46, QUEEN VICTORIA STREET, E.C.

At the Mart, Tokenhouse Yard, to-day, Mr. Alfred Richards will offer for sale shares in the Romford, Slough, Uxbridge, and Wandsworth Gas Companies, and in the Great Yarmouth Water Company.

Messrs. Arden Hill and Co., of Birmingham, have obtained a contract to fit up the laboratories, workshops, doctors' residences, &c., of the Jenner Institute, at Aldenham, with a complete gas installation, including fittings and services.

The Massachusetts House of Representatives has rejected a Bill which sought to provide for annual investigations by the Board of Gas and Electric Light Commissioners of the prices at which gas and electricity are furnished throughout the State.

Messrs. R. Dempster and Sons, Limited, of Elland, have received the order for coke screening and conveying plant for the Saltley Gas-Works of the Birmingham Corporation, to be erected according to plans and specifications prepared by Mr. Henry Hack, the Engineer.

In order to keep pace with the increased demand for gas, steps are being taken by the Gas Company for improving the supply to Leatherhead and the district. A new trunk main, 12 inches in diameter, is being laid from the works into the town, in place of the old one, which has been in use 35 years.

Messrs. Joseph Taylor and Co., of Bolton, have received an order from the Dewsbury Corporation for a 1½-inch solid plate lead saturator of their best and latest make, with 1¾-inch plated lead well, for steam discharge. The saturator is to be fitted with double detachable ammonia pipes and detachable acid pipe.

We learn that the arrangements which have for some time past subsisted between the Richmond Gas Stove and Meter Company, Limited, and the Gas Companies at Dublin and Bournemouth, for the fitting up of slot-meter installations, are still working satisfactorily. Over 10,000 installations have already been completed at Dublin, and 4000 at Bournemouth.

Correspondents of firms whose offices are situated in what have hitherto been known as Palmerston Buildings, Old Broad Street, E.C., will do well to note, in order to avoid delay in delivery, that the name has been changed to Palmerston House. Among "JOURNAL" advertisers with offices in Palmerston House are the Gas Purification and Chemical Company, Limited, and Mr. Andrew Stephenson.

Messrs. John Wright and Co., of Birmingham, in conjunction with the Sutherland Meter Company, have just been successful in securing a contract with the Reading Gas Company for the supply and fixing of prepayment stoves, meters, brackets, pendants, &c., throughout their district. The order is a very large one—the number of houses to be fitted up amounting to about 10,000—and, under these circumstances, it is not surprising to learn that the competition to secure it was very keen indeed. The two firms are to be congratulated upon obtaining such an important piece of work; and credit is due to them for their achievement.

The "Westminster Gazette" is responsible for the following: "Complaints are being made of the obscure lighting of the auditorium at Covent Garden during some of the Wagnerian operas. In former days it was quite an opposite charge which was raised against the master. Then frugal German managers chiefly complained of the long gas bills entailed by his works. In this connection, an amusing story is told respecting a certain manager who, compelled by public opinion to bring out 'Tristan,' tried to come to terms with the composer. 'Cut half-an-hour out of each act,' he suggested, 'and I will mount the work and give you 10 per cent. of the receipts. With what I shall save in gas I can do that.' 'Very sorry,' replied Wagner; 'I am obliged to forbid you to omit a single note in any of my works.' 'But why?' 'For the best of reasons—I am a large shareholder in the Gas Company.'"

At the end of last year, West's Gas Improvement Company, Limited, made an arrangement with the Riter-Conley Manufacturing Company, of Pittsburg and New York (one of the leading firms in America for the production of gas appliances), for the sole right to manufacture West's compressed air stoking machinery in the United States. Mr. John West has recently made a prolonged visit to the States in connection with this matter; and during his stay he went to a large number of towns—including New York, Philadelphia, Washington, Baltimore, Pittsburg, St. Louis, Chicago, Cincinnatti, Cleveland, Toledo, and Milwaukee—and met most of the leading gas engineers. He informs us that during the whole time he was received with the greatest courtesy and friendly feeling, which is a characteristic of the Americans. It is pleasing to note that the Riter-Conley Manufacturing Company have already received contracts for installations of West's stoking machinery from the Milwaukee and Lowell Gas Companies; and, judging by the numerous inquiries, they expect to do a large business in this plant.

At the last Meeting of the Common Council of the City of London, the Streets Committee presented a report recommending that incandescent burners should be substituted for the flat-flame burners on the existing gas-lamps in the side streets in the neighbourhood of Bishopsgate Street Without, north of Liverpool Street, and of New Street, and that 17 extra new lamps fitted with incandescent burners should be fixed thereat, at an estimated cost of £349. With reference to a complaint as to the want of additional lighting in Pilgrim Street, Ludgate Hill, the Committee stated that they had given instructions for incandescent burners to be substituted for the flat-flame burners on the existing gas-lamps thereat, and for two new lamps, fitted with incandescent burners, at an estimated total cost of £33. With regard to the want of additional lighting in Three Nuns Passage, Newgate Street, and Dean's Court, Old Bailey, the Committee stated that they had given instructions for an additional lamp, fitted with incandescent burner, to be fixed in each of the thoroughfares, at a cost of about £10. All these proceedings were approved of.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571 Central.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON HOUSE,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications RE OXIDE to the COMPANY as above.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

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FOR GAS PURIFICATION.

THE DUNSTABLE LIME COMPANY,

Works: Sewell, Dunstable, Knebworth, Stamford, and Peterborough, Great Northern, Midland, and London and North-Western Railways.

Copy of Analysis of Lime from Knebworth Works—

Calcium Oxide (Quick Lime) . .	98·9
Magnesia and Alumina	0·5
Silica	0·6
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Head Office: PETERBOROUGH.

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Offices: Commercial Buildings, LEEDS. Correspondence invited.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

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EERSTE Hollandsche Yzererts Maaty. (The First Dutch Bog-Ore Company, Limited), ROTTERDAM.

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England—C. E. FRY, Tower Chambers, Brown St., MANCHESTER.

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NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

PROVINCIAL Gas Companies may profitably consider the advantages offered by ACETYLENE for the PUBLIC and PRIVATE LIGHTING of OUTLYING PORTIONS OF THEIR DISTRICTS, which do not at present justify the expense of laying Coal-Gas Mains from the Central Works.

Correspondence on this subject is invited by the ACETYLENE ILLUMINATING COMPANY, LIMITED, 3, Victoria Street, LONDON, S.W.

COAL GAS TAR wanted.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

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FIRE Cement, Paint, Mains, Tubes, STREET LANTERNS, GLASS, TOOLS, &c.

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5, CROOKED LANE, CANNON STREET,
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BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.

HIGH CLASS CYCLES at lowest Prices guaranteed and sent on APPROVAL for Cash or GRADUAL PAYMENTS. Catalogue and Testimonials from Gas Managers post free.

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For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

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Twice as Rich as Bog Ore.
Gives no Back Pressure.
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STREET LAMPS AND LANTERNS.

MARK DUFFIELD & SONS, Engineers and Contractors to the Principal Home and Foreign Gas and Electric Companies, invite inquiries.

London Manager, EDWARD PADFIELD, 27, Leadenhall Street, E.C. Telegrams: "Eupathy, London."

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H. GREENE & SONS, Ltd., are pre- pared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

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MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

WANTED, re-engagement as Working MANAGER of small Gas-Works. Practical Carbonizer, Gas-Fitter, Main and Service Layer, &c. Age 49. Abstainer. Excellent Testimonials.

Address No. 3864, care of Mr. King, 11, Bolt Court FLEET STREET, E.C.

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Apply, by letter, to the MANAGER, Gas-Works, COVENTRY.

WANTED, a good Stoker used to Shovel Charging. None but steady Men need apply. Wages 5½. per shift.

Apply to the MANAGER, Gas-Works, GRAYS.

TO GAS-WORKS MANAGERS.

WANTED, a Manager for a small Gas- Works in Central Spain. No one need apply who cannot speak and write Spanish.

Address No. 3861, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a thoroughly experienced ENGINEER, capable of Superintending the erection of Water-Gas Plant, and also supervision of operating the same on completion. Good Salary for a capable Man.

Apply, in the first instance, by letter, to No 3866, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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WANTED, a Working Foreman. Must be a good Carbonizer, and able to do the necessary Fittings for Services and Gas Cooking Stoves. Gas-Engine and Exhauster. House on Premises, Rent free, with Gas and Coal found.

Apply, stating Wages required, on or before Thursday, May 29, to E. F. PARKER, Secretary, Gas Company, Harlow, ESSEX.

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WANTED, the Services of a capable man with good knowledge of MAIN and SERVICE LAYING, and accustomed to the control of Workmen.

Applications, giving full particulars of Age, Experience, and Wages expected, together with *copies* of Testimonials, to be sent at once to F. G. DEXTER, Engineer and Manager, Water and Gas Company, WINCHESTER.

BOROUGH OF RAMSGATE.

GAS AND WATER ENGINEER.

THE Council invite applications for the position of ENGINEER and MANAGER of the Gas and Water Departments, which will be vacant on the 25th of September next. Applicants must have had previous experience in the duties of both Departments. The annual Salary will be £500; and Staff and Offices will be provided by the Council. The gentleman appointed will not be allowed to carry on private practice, but will be required to devote his whole time to the duties of his office.

Applications, stating the Age and Experience of the candidate, and accompanied by not more than four recent Testimonials, to be sent, addressed to the undersigned and endorsed "Engineership," on or before the 7th of June, 1902.

In addition to the formal application, twenty-five prints of the same and of the Testimonials should be forwarded for the information of the Council.

Canvassing members of the Council is strictly prohibited, and will disqualify the person pursuing it.

W. A. HUBBARD,
Town Clerk.

Municipal Offices,
Ramsgate, May 13, 1902.

WANTED, Young Man, experienced in laying Services, Fixing Meters, and General Gas Work. Wages 26s. weekly.

Apply, by letter, to the MANAGER, Gas-Works, DARTFORD.

GAS STOVE AND METER TRADE.

TRAVELLER, disengaged shortly, seeks appointment with good Firm. Five years' experience in the English Counties. Knowledge of "Slot" Installation Work.

Address No. 3867 care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AMMONIACAL Liquor, 6° Twaddel, about 2000 Gallons for Sale. OFFERS requested put on rail in purchaser's own barrels.

Address MANAGER. Gas-Works, Gedstone Station, S.E. & C. Ry.

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Apply to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

TO BE SOLD—

10-inch SCRUBBER-WASHER, by Clapham, overhauled and perfect.
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FOR SALE—Cheap, Three Single- Mantle KITSON LAMPS and one Double-Mantle KITSON LAMP, with Oil-Tank and all necessary connections. In good working condition.

Apply to GEO. BRAY & Co., Bagby Works, LEEDS.

FOR DISPOSAL—A Coal-Gas Plant complete, capable of producing 130,000 cubic feet of Gas per day. In sound condition. Full Particulars on application.

Address "G.W.," care of Davies and Co., Advertising Agents, 23, Finch Lane, CORNHILL.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill DEWSBURY.

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A TWO-LIFT Gasholder in good con- dition. Working capacity 25,500 cubic feet. Diameter of Outer Lift, 35 ft. by 14 ft. deep. Six Cast-Iron Columns.

Price to include taking down and removal.

Apply to MANAGER, Gas-Works, Nantwich, CHESHIRE.

FOR SALE—Six Egg-ended Boilers, each 35 ft. by 5 ft. diameter. Hold about 4000 gallons each; for Tar or Liquor. £23 each on rail.

Also COLUMNS and ROLLED JOISTS forming staging for Purifiers. Area 75 ft. by 65 ft. 12 ft. 6 in. from floor to top of Joists. Columns 12 inches diameter. Rolled joists 18 in. by 7 in., and 14 in. by 6 in. Stone Bases, if required, 38 in. by 38 in. by 24 in. All cheap.

Apply, by letter, to No. 3865, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale of all kinds.

GASHOLDERS, 15 ft. to 50 ft. diameter.
Iron or Steel TANKS for ditto.
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CONDENSERS—Pipe, Annular, and Patent Condensers.
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RETORT-FITTINGS, METERS, GOVERNORS, VALVES, &c.
Every Description of NEW PLANT supplied.

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GASHOLDER, 14 ft. by 10 ft. with 3 Columns and Suspension.
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Write J. WRIGHT, 181, Queen Victoria Street, E.C.

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One BATTERY CONDENSER, complete with 10-inch Valves and Inlet and Outlet Pipes.
One 250,000 cubic feet per diem KIRKHAM, HULETT, and CHANDLER WASHER-SCRUBBER.
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One EXHAUSTER, passing 20,000 cubic feet per hour.
One EXHAUSTER, passing 15,000 cubic feet per hour.
One STEAM GOVERNOR & SMALL ENGINE.

All in good condition.

JAS. L. CHAPMAN,
Engineer and Secretary.

Gas-Works, Harrow.

SPECIAL OFFER of Gas Purifiers.

Six Perfect 20 feet Square PURIFIERS, planed Joints, Lutes 2 feet deep, made to Newbigging's Specification. Bargain to early Purchasers.

FIRTH BLAKELEY, DEWSBURY.

CIRENCESTER GAS COMPANY, LIMITED.

TENDERS FOR GAS COAL.

THE Directors are prepared to receive TENDERS for the supply of 4000 Tons of GAS COAL during the Twelve Months commencing July 1 next.

Tenders, stating Price delivered to the Watermoor Station of the Mid. and South-Western Junction Railway Company to be sent in by the 4th day of June next.

The Directors reserve the right to accept Tenders for Six Months only, if so desired.

J. P. BEECHAM,
Secretary.

12, Silver Street, Cirencester,
May 12, 1902.

CITY OF CARLISLE.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the purchase of the surplus TAR produced at their Works for a period of One Year from the 1st of July next.

Tenders, endorsed "Tar," and addressed to the Chairman of the Gas Committee, to be delivered at the Office of the Town Clerk, not later than June 2, 1902.

Further Particulars can be obtained on application to W. J. Smith, Engineer and Manager.

By order,
A. H. COLLINGWOOD,
Town Clerk.

Carlisle, May 15, 1902.

CITY OF CARLISLE.

THE Carlisle Gas and Water Committee are prepared to receive TENDERS for the COAL and CANNEL required at their respective Works during One Year from the 1st of July next.

Tenders, endorsed "Coal," and addressed to the Chairman of the Gas and Water Committee, to be delivered at the Office of the Town Clerk not later than June 2, 1902.

Forms of Tender and other Particulars may be had on application to W. J. Smith, Gas Engineer and Manager, for Gas Coal; and H. C. Marks, Water Engineer, for Coal for Water-Works.

By order,
A. H. COLLINGWOOD,
Town Clerk.

Carlisle, May 15, 1902.

COUNTY BOROUGH OF OLDHAM.

THE Oldham Corporation Gas-Works Committee are prepared to receive TENDERS for the supply of about 113,000 Tons of COAL and CANNEL required by them during the Year ending the 30th of June, 1903.

Specifications and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom Tenders are to be sent on or before Tuesday, the 17th of June.

A. NICHOLSON,
Town Clerk.

Oldham, May 23, 1902.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee invite TENDERS for the TAR and AMMONIACAL LIQUOR to be produced at their different Gas Stations for a period of One or more Years, commencing the 1st of July next.

The Yearly make of Tar is about 8000 Tons, and of Ammoniacal Liquor about 2,500,000 Gallons.

Particulars and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom Tenders are to be sent on or before Tuesday, June 17, 1902.

A. NICHOLSON,
Town Clerk.

Oldham, May 22, 1902.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Cor- poration invite TENDERS for the supply of 26,000 Tons of screened GAS COALS and NUTS, to be delivered during a period commencing the 1st of July, 1902, and terminating the 30th of June, 1903.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 14th of June next.

The Committee do not bind themselves to accept the lowest or any Tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
May 24, 1902.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR TAR.

THE Gas Committee of the Corporation of Lincoln are prepared to receive TENDERS for the purchase of the surplus TAR (about 1000 Tons) produced at their Works during the period of One Year commencing on the 1st of July, 1902.

Sealed Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Residuals," must be delivered at the Gas Offices, Lincoln, on or before the 14th of June next.

The Committee do not bind themselves to accept the highest or any Tender.

Other Particulars may be obtained of the undersigned.

JNO. CARTER.
Manager.

Gas Offices, Lincoln,
May 24, 1902.

URBAN DISTRICT COUNCIL OF STOURBRIDGE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply and delivery of 15,000 Tons of GAS COAL.

Forms of Tender, &c., may be had on application to the undersigned. Only offers on our own Form will be considered.

Tenders, endorsed "Gas Coal," and addressed to the Chairman of the Gas Committee, to be sent to me at the Gas-Works, Stourbridge, on or before Tuesday, the 17th day of June, 1902.

The lowest or any Tender not necessarily accepted.

By order,
WM. NORTH,
Engineer and Manager.

Stourbridge Gas-Works,
May 24, 1902.

THE Caterham and District Gas Company invite TENDERS for the supply of the following—

About 1650 Yards of 15-inch CAST-IRON PIPES, in 12-feet lengths, Open Joints.
About 1000 Yards of 12-inch CAST-IRON PIPES, in 12-feet lengths, Open Joints.
About 7 Tons of PIG LEAD,

to be delivered in quantities as desired by the Engineer during the months of July and August or August and September at the Warlingham Station, S.E. & C Ry. Caterham Branch.

Further Particulars may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Pipe Tenders," specifying Weights of each Pipe respectively, should be addressed to the Chairman, Gas-Works, Whyteleafe S.O., Surrey, not later than the 9th of June, 1902. Offers to remain open Fifteen days after that date.

The Company reserve to themselves the right to split the Tender, and do not bind themselves to accept the lowest or any Tender.

D. H. ANDERSON,
Engineer and Secretary.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the supply of about 3600 Tons (or such other quantity as may be agreed on) of best approved GAS COALS, to be delivered in such monthly quantities as may be required by the Company.

Tenders to state the price of the Coal delivered at Paignton Station (Great Western Railway) free of all charges.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained on application to Mr. C. G. Dawson, the Company's Manager.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 7th of June, addressed to the undersigned, Gas Offices, 5, Victoria Street, Paignton.

F. W. PUDDICOMBE.
Secretary.

Paignton, May 23, 1902.

MATLOCK AND DISTRICT GAS COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for GAS COAL for the year ending June 30, 1903; well screened and free from bats, bind, pyrites, and rubbish.

The quantity required will be 4500 Tons or thereabouts; but persons desiring to tender for a less quantity may do so.

The Contractor will be required to provide sufficient Coal for the requirements of the Company for the above period, delivered in such quantities per month or per week as the Manager may deem necessary.

Offers must state the name of the Colliery from which the Coal is to be obtained, and the price per ton of 20 cwt. delivered free on rails at Matlock Bridge Station on the Midland Railway.

Payments to be made monthly for previous month's delivery.

Sealed Tenders, endorsed "Tender for Coal," should be sent to the undersigned on or before Monday, the 16th day of June, 1902.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

The Contractor to tender on own Form.

ROBERT HALL,
Secretary.

Gas Offices: Victoria Buildings,
Matlock, May 23, 1902.

THE Llandudno Urban District Council invite TENDERS for the supply of 7000 Tons of best screened GAS COAL, capable of producing a minimum of 10,000 cubic feet of 18-candle gas per ton, to be delivered, carriage paid, between the 1st of July next and the 30th of June, 1903, at the Llandudno Station of the London and North-Western Railway, in such quantities and at such periods as may be ordered from time to time.

Forms of Tender may be obtained on application to the undersigned; and only such Tenders as are upon the prescribed form will be considered.

In every case where the particulars asked for are not given, the Tenders will be thrown out and not considered.

Tenders must be sent to the undersigned not later than the 3rd day of June next.

The Tender of any person or firm who personally, or through an agent, canvasses any of the officers or members of the Council will be rejected.

The Council do not bind themselves to accept the lowest or any Tender, and they will not consider the Tender of any person or firm who shall on any previous occasion within the past two years have withdrawn a Tender after the same has been opened, unless the reasons for the withdrawal were satisfactory to the Council.

ALFRED CONOLLY,
Clerk to the Council.

May, 1902.

THE INCORPORATED

Gas Institute.

THE THIRTY-NINTH

ANNUAL GENERAL MEETING

OF THE MEMBERS

WILL BE HELD ON

TUESDAY (10.30 a.m.),
WEDNESDAY (10 a.m.), and
THURSDAY (10 a.m.),

the 10th, 11th, and 12th of June, 1902,

AT THE

ROYAL VICTORIA ROOMS,

PORTLAND TERRACE, SOUTHAMPTON.

THE CHAIR WILL BE TAKEN BY THE PRESIDENT,

S. WESTALL DURKIN, Esq.

On Friday, June 13, there will be an EXCURSION to the Isle of Wight. Full Particulars are announced in the Programme.

THE BENEVOLENT FUND.

The Annual Meeting of the Donors and Subscribers to the Benevolent Fund will take place on Wednesday, June 11, at the close of the sitting, about Two p.m.

WALTER T. DUNN, Secretary.

39, Victoria Street, Westminster, S.W.

CITY OF RIPON.

THE Corporation are prepared to receive TENDERS for the supply of 3000 Tons of GAS COALS.

For Particulars, apply to Mr. W. T. Lancaster, Gas Manager.

Sealed Tenders to be sent to me on or before Wednesday, the 4th day of June next.

By order.
M. KIRKLEY.
Town Clerk.

Town Hall, Ripon,
May 23, 1902.

HOLBEACH GAS AND COKE COMPANY, LIMITED.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 700 Tons of GAS COAL (Railway Weight), to be delivered at the Holbeach Railway Station at such times, and in such quantities, as the Company shall require.

Terms of payment, 80 per cent. on each delivery, and the balance on completion of the Contract.

Tenders, marked "Tender for Gas Coal," stating names of Coal and Analysis, to be sent to me not later than Two p.m. on Thursday, the 12th of June next.

No Form of Tender supplied.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
THOS. C. WILLDERS,
Secretary.

Holbeach,
May 20, 1902.

COUNTY BOROUGH OF WEST BROMWICH.
(GAS DEPARTMENT.)

TO COLLIERY PROPRIETORS.

THE Gas Committee are prepared to receive TENDERS for the supply of about 28,000 Tons of GAS COAL and NUTS for delivery at their Works, Albion, West Bromwich, between July 1, 1902, and June 30, 1903.

The Committee do not bind themselves to accept the lowest or any Tender, and they reserve to themselves the right to divide the Contract between several firms.

Forms of Tender may be obtained upon application to Mr. Harold E. Copp, Engineer.

Sealed Tenders, properly endorsed, to be sent to me not later than Tuesday, the 10th of June.

By order,
THOS. HUDSON.
Secretary.

Town Hall, West Bromwich,
May 23, 1902.

SLOUGH GAS AND COKE COMPANY.

THE Directors are prepared to receive TENDERS for the supply of 4500 Tons of either of the following GAS COALS—viz., East Pontop, Ravensworth Pelaw, Pelaw Main, Londonderry, New Pelton, Aldwarke Silkstone, and Best Yorkshire Silkstone, ex Thorncliffe Collieries, to be delivered at the Great Western Railway Station, Slough, in the usual monthly quantities as may be required during the period of One Year from the 1st day of August, 1902.

Payment for Coal on or before the 20th of the following month after delivery.

Tenders to be delivered to the undersigned, endorsed "Tender for Gas Coal," on or before Tuesday, the 10th prox.

The Directors do not bind themselves to accept the lowest or any Tender.

ARTHUR THOMAS,
Secretary.

High Street, Slough,
May 24, 1902.

THE Sheppy Gas Company invite TENDERS for the RELAYING of about 900 Yards of 6-inch GAS-MAIN, with all Connections and Syphons.

Particulars may be had on application, and Tenders addressed to

H. BARBER,
Secretary.

Offices: 2, Trinity Road,
Sheerness-on-Sea.

BOROUGH OF CHORLEY.

TO COLLIERY OWNERS AND OTHERS.

THE Chorley Corporation invite Tenders for the supply of GAS FUEL required at their Gas-Works, for a period of Twelve Months from the 1st of July, 1902, to the 30th of June, 1903.

Forms of Tender and Particulars and Quantities may be obtained on application to Mr. J. W. Allin, Gas Engineer, Chorley.

Tenders, endorsed "Gas Fuel," to be sent to me, on or before Saturday, June 7, 1902.

The Corporation do not bind themselves to accept any Tender.

By order,
JNO MILLS,
Town Clerk.

Town Hall, Chorley,
May 14, 1902.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas-light Company, invite TENDERS for the supply of about 15,000 Tons of screened GAS COALS, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the Year commencing July 1, 1902, and ending June 30, 1903.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any Tender.

Tenders must be made on Forms (containing further particulars) which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned on or before the 16th day of June, 1902.

By order,
WM. BELTON, Assoc. M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 16, 1902.

BOROUGH OF BRIGHOUSE.

TENDERS FOR GAS COAL, SCREENED NUTS, CANNEL, AND LIME.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of GAS COAL, SCREENED NUTS, CANNEL, and BUXTON LIME, required at the Mill Lane and Birds Royd Gas-Works during the Year ending the 30th of June, 1903.

Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Mill Lane, Brighouse.

Sealed Tenders, stating price per ton delivered at the Gas-Works, or alongside the Gas-Works by the Calder and Hebble Canal, or at the Brighouse Railway Station, must be sent in on or before Saturday, the 31st day of May, 1902, addressed to the Town Clerk, Municipal Offices, Brighouse, and endorsed on the outside "Tender for Coal" or "Lime," as the case may be.

The lowest or any Tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Town Clerk's Office,
Brighouse, May 15, 1902.

TYLDESLEY-WITH-SHAKERLEY URBAN DISTRICT COUNCIL.

THIS Council invite Tenders for the purchase of the surplus TAR and AMMONIACAL LIQUOR to be produced at their Gas-Works for the Year ending the 30th of June, 1903.

Further Particulars may be obtained on application to Mr. W. H. S. Gendall, Engineer, Gas-Works, Tyldesley.

Sealed Tenders, on authorized forms only, which can be obtained from the Engineer, and endorsed "Tar and Liquor," to be delivered to the undersigned not later than the 10th day of June, 1902.

The Council do not bind themselves to accept the highest or any Tender.

By order,
WM. J. MATTHEWS,
Clerk to the Council.

Council offices,
Tyldesley, near Manchester,
May 16, 1902.

TYLDESLEY-WITH-SHAKERLEY URBAN DISTRICT COUNCIL.

THIS Council invite Tenders for the supply at the Gas-Works, Tyldesley, of the under mentioned articles:—

40.0 Tons of COAL.
CAST-IRON PIPES.
CAST-IRON SPECIALS.
LEAD (Gas and Water) PIPING.
LIME.
One WROUGHT-IRON CHIMNEY.

Further Particulars as to same may be obtained on application to Mr. W. H. S. Gendall, Engineer, Gas-Works, Tyldesley.

Sealed Tenders, on authorized forms only, which will be supplied by the Engineer on application, to be sent to the undersigned, endorsed "Tender for....." not later than Tuesday, the 10th day of June, 1902.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
WM. J. MATTHEWS,
Clerk to the Council.

Council Offices,
Tyldesley, near Manchester,
May 16, 1902.

RHYMNEY AND ABER VALLEYS GAS AND WATER COMPANY.

TO CAST-IRON PIPE FOUNDERS.

TENDERS are required for the supply and delivery of 3390 Yards of 6 inch by 9 feet Cast-Iron plain Socket and Spigot WATER PIPES and IRREGULARS.

Particulars and Specification can be obtained on application to the undersigned.

ALBERT R. CAWLEY,
General Manager.

Caerphilly, near Cardiff.

TO GAS COMPANIES AND OTHERS.

TENDERS.

THE Aberdeen Steam Navigation Company require TENDERS for the purchase of their HYDRAULIC INSTALLATION at Aberdeen Wharf, Limehouse, E.

Full Particulars may be obtained on application to their Engineer, Mr. John J. Robson, Assoc.M.Inst.C.E., Suffolk House, Laurence Pountney Hill, London, E.C., to whom Tenders should be sent on or before Monday, June 2, 1902.

The Machinery may be inspected any day on application to the Manager.

At present this Machinery is supplying power to Four 2-Ton Cranes and One Capstan.

PETERBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of best screened GAS COAL, COBBLES, NUTS, and CANNEL for One Year, commencing the 1st of July next.

Forms of Tender and Conditions may be obtained on application to the undersigned.

Tenders to be sent in by the 9th of June next, endorsed "Coal," and addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any Tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, Peterborough,
May 16, 1902.

TO ENGINEERS AND IRONFOUNDERS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply and erection, at their Neepsend Station, of Eight PURIFIER COVERS, 20 ft. 2 in. square, and 3 ft. 3 in. deep, of Steel and Wrought Iron.

Drawing may be seen, and Particulars obtained, at the Company's Office, Commercial Street, on application to the Engineer, Mr. J. W. Morrison.

The Directors do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Purifier Covers," must be delivered by post not later than the first post on Saturday, the 31st day of May, addressed to the undersigned.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
May 14, 1902.

BOROUGH OF CLITHEROE.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for the supply of 3500 Tons of screened GAS COAL and 1000 Tons of SLACK, to be delivered during the Year ending June 30, 1903.

Further Particulars and Form of Tender may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Monday, the 2nd of June, 1902.

ROBT. BARRETT,
Manager.

Gas-Works, Clitheroe,
May 16, 1902.

BOROUGH OF DONCASTER.

TENDERS FOR COAL.

THE Gas Committee of the Borough of Doncaster are prepared to receive TENDERS for the supply of 20,000 Tons of best screened GAS COAL, during a period commencing July 1, 1902, and terminating June 30, 1903.

Particulars and Tender Forms may be obtained on application to the Chairman, or to the undersigned.

Tenders should be sent, under seal, to the Chairman, endorsed "Tender for Coal," not later than Ten a.m., on Thursday, June 12.

By order of the Gas Committee, who do not bind themselves to accept the lowest or any Tender.

R. BRIDGE,
Engineer.

Gas-Works, Doncaster,
May 20, 1902.

ACCRINGTON DISTRICT GAS AND WATER BOARD.

THIS Board invite Tenders for the surplus TAR and AMMONIACAL LIQUOR which may be produced at the Accrington and Great Harwood Works of the Board, during the Year from the 1st of July next to the 30th of June, 1903.

The estimated quantity of Tar is 1800 Tons, and Liquor 5000 Tons.

Sealed Tenders, endorsed "Tar and Liquor," addressed to the Chairman of the Board, must be in my hands on or before Tuesday, the 10th of June.

Forms of Tender may be obtained on application.

By order,
CHARLES HARRISON,
General Manager.

General Offices, Accrington,
May 13, 1902.

THE Directors of the Prescot Gas Company are prepared to receive TENDERS for the Surplus TAR produced at their Works, during the Twelve Months ending May 31, 1903.

The quantity will be about 230 tons.

Terms net cash, 20th of the month following delivery.

Tenders, endorsed "Tar," to be sent in to the undersigned on or before Tuesday, June 17, next.

The Directors do not bind themselves to accept the highest or any Tender.

JOHN E. HALL,
Manager and Secretary.

Gas-Works, Moss Street,
Prescot.

OXFORD GASLIGHT AND COKE COMPANY.

THE Directors invite Tenders for the supply of about 33,000 Tons of best screened GAS COAL, to be delivered to their Siding, G.W.R., during the Year ending June 30, 1903.

Tenders, addressed to the Chairman of the Oxford Gaslight and Coke Company, and endorsed "Tender for Coal," to be delivered by June 10, 1902.

By order,
JAMES ELDRIDGE,
Engineer and Manager.

THE Stafford Corporation Gas and Electricity Committee are prepared to receive TENDERS for the surplus TAR produced at their Works from the 1st of June, 1902, for a period of One, Three, or Five Years.

Forms of Tender to be obtained from the undersigned.

The Committee do not bind themselves to accept the highest or any Tender.

Tenders, endorsed "Tenders for Tar," to be delivered at the Gas Offices not later than Five p.m. on Friday, the 30th inst.

HUBERT POOLEY,
Engineer.

May 23, 1902.

TENDERS FOR GAS COAL.

THE Corporation Gas Committee of Stoke-upon-Trent invite TENDERS for the supply of 13,000 Tons of GAS COAL.

Specification and Form of Tender may be obtained on application to the undersigned, or at the Gas Offices.

Tenders to be sent in not later than Twelve o'clock noon on the 12th day of June, 1902, addressed to F. Geen, Esq., J.P., Chairman of the Gas Committee, Stoke-upon-Trent, and endorsed "Tender for Gas Coal."

WM. PRINCE,
Engineer and Manager.

Gas Offices, Stoke-upon-Trent,
May, 1902.

TO COAL MERCHANTS, SHIP OWNERS, AND OTHERS.

THE Directors of the Torquay Gas Company are prepared to receive TENDERS for the supply of about 16,000 Tons (or such other quantity as may be agreed on) of best approved GAS COALS.

Tenders to state the price of the Coals, and the freight to Dartmouth or Torquay, separately and together, and also for delivery into the Company's Works, adjoining the Great Western Railway, free of all charges.

Further Particulars and Forms of Tender may be obtained from Mr. Beynon, the Manager of the Company, Hollacombe, Paignton, and Tenders are to be sent to the undersigned before the 3rd day of June next.

JOHN KITSON,
Secretary.

Torquay, May 17, 1902.

COUNTY BOROUGH OF BURY.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of
40,000 Tons of GAS COAL,
500 ,, of BURGY (more or less.)
300 ,, of HOUSE COAL (do.)

Forms of Tender and Conditions of Contract may be obtained on application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

Tenders, endorsed "Gas Coal," to be addressed to the Chairman of the Gas Committee, Town Clerk's Office, Bank Street, Bury, and delivered not later than Saturday, the 14th day of June next.

JOHN HASLAM,
Town Clerk.

Corporation Offices,
Bank Street, Bury,
May 22, 1902.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 33,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Sidings, Hempsted, near Gloucester, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the undersigned.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than Monday, the 2nd day of June next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 1, 1902.

THE Directors of the Kildwick Parish Gas Company invite TENDERS for the supply of the whole or part of 4000 Tons of GAS COAL or NUTS, to be delivered free in the Company's Siding at Kildwick, during the Twelve Months ending June 30, 1903.

Tenders to be sent in not later than June 2, 1902, to

FRED. H. PICKLES,
Manager and Secretary.

Gas-Works, Kildwick,
May 20, 1902.

THE Directors of the Knutsford Light and Water Company invite TENDERS for the supply of 2200 Tons of the best GAS COAL (screened), and 150 Tons of the best GAS CANNEL, to be delivered during the Year ending May 31, 1903, at Knutsford Station.

Tenders to be sent in to the Chairman of the Company, Knutsford, not later than the 28th inst.

The Company do not bind themselves to accept the lowest or any Tender.

TENDERS FOR COAL.

THE Directors of the Mold Gas and Water Company are prepared to receive TENDERS for the supply of about 1500 Tons of GAS COAL, to be delivered on the Company's Siding in such quantities and at such times as the Manager shall from time to time direct.

Tenders, endorsed "Coal," to be delivered to the undersigned not later than June 6.

J. M'GREGOR,
Secretary and Manager.

Gas and Water Office, Mold.

HINCKLEY URBAN DISTRICT COUNCIL.

THE Gas Committee invite Tenders for the supply of COAL, LIME, and SULPHURIC ACID, and also for the purchase of TAR.

Full Particulars and Form of Tender may be obtained from Mr. Fred Lee, Gas Manager.

Endorsed Tenders to be sent to me not later than Monday, June 2, 1902.

A. S. ATKINS,
Clerk.

Hinckley, May 14, 1902.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of 12,000 Tons of COAL.

Specification and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.

Sealed Tenders, endorsed "Coal," to be sent to me not later than Tuesday, June 17, 1902.

By order,
GEO. G. BOUCHIER,
Town Clerk.

Municipal Buildings, Heywood,
May 14, 1902.

HEXHAM GAS COMPANY.

THE Directors invite Tenders for about 4500 Tons of unscreened GAS COAL, to be delivered at Hexham Station as required during the Year ending June 30, 1903.

Tenders, accompanied by copy of recent Analysis of the Coal offered, and stating the name of the pit at which it is raised, must be delivered to the undersigned not later than Tuesday, June 3, 1902.

HERBERT LEES,
Engineer and Secretary.

Hexham, May 21, 1902.

ROCHESTER, CHATHAM, AND STROOD GASLIGHT COMPANY.

SUPPLY OF GAS COAL.

THE Directors invite Tenders for the supply of about 47,000 Tons of GAS COAL, to be delivered between the 1st of July, 1902, and the 30th of June, 1903.

Further Particulars, with Forms of Contract and Tender, may be had on application, and sealed Tenders, marked "Coal," are to be delivered to me at these Offices, not later than Noon of Tuesday, the 10th of June, 1902.

J. M. VEEVERS,
Engineer and Secretary.

Gas Offices, Rochester,
May 15, 1902.

THE Stretford Gas Company are prepared to receive TENDERS for the surplus GAS TAR and AMMONIACAL LIQUOR produced at their Works (together or separately) for a period of One, Two or Three Years, commencing July 1, 1902.

The Directors are prepared to make the Contract on the Sliding-Scale Basis, or otherwise.

Tenders to be sent in, addressed to the Chairman, endorsed "Tender for Tar, &c.," on or before Tuesday, June 10, 1902.

Form of Tender may be obtained from the Secretary.

The Directors do not bind themselves to accept the highest or any Tender.

BENJAMIN HAYNES,
Secretary.

CHELSEA WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY GENERAL MEETING of the Governor and Company of Chelsea Water-Works will be held at their Office, Commercial Road, Pimlico, in the County of London, on Thursday, the 19th day of June prox., at One o'clock in the Afternoon precisely, for the General Business of the Company.

The REGISTER of TRANSFERS WILL BE CLOSED between the 7th day of June prox., and the 19th day of June prox., both days inclusive.

By order,
G. H. GILL,
Secretary.

Office, 41, Commercial Road,
Pimlico, May 24, 1902.

BROUGHTY FERRY TOWN COUNCIL.

THE Gas Department request Tenders for GAS COALS (SMALL, NUTS, &c.) for Twelve Months.

Offers to be lodged with the undersigned not later than Noon on Friday, the 30th inst.

FORBES WADDELL,
Manager and Engineer.

LEIGH-ON-SEA URBAN DISTRICT COUNCIL.

THE Leigh-on-Sea Urban District Council invite TENDERS for the supply of 700 Tons of good GAS COAL, to be delivered at the Gas-Works Wharf, Leigh-on-Sea, as required, in quantities of not more than 80 Tons.

Sealed Tenders, endorsed "Tender for Coal," must be received by me not later than the 2th of June next.

ALFRED J. ARTHY,
Clerk to the Council.

Council Offices, Leigh-on-Sea.
May 21, 1902.

NORTHWICH GAS COMPANY.

THE Directors of the Northwich Gas Company invite TENDERS for the supply and delivery at Northwich Railway Station of about 5000 Tons of GAS COAL during the Year ending June 30, 1903.

Tenders, endorsed "Coal," and addressed to the Chairman, must be delivered here not later than Friday, June 6, 1902.

Form of Tender and any other Particulars can be had from the undersigned.

SAML. S. MELLOR,
Manager and Secretary.

Gas-Works, Northwich,
May 21, 1902.

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

SALE BY TENDER of £30,000 THREE-AND-A-HALF PER CENT. DEBENTURE STOCK.

MINIMUM PRICE, £100 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £30,000 of THREE-AND-A-HALF PER CENT. DEBENTURE STOCK, to be issued under the provisions of the Newcastle-upon-Tyne and Gateshead Gas Act, 1896.

Particulars and Forms of Tender may be obtained on application to the undersigned, and Tenders must be sent in so as to be received at the Office of the Company not later than Ten a.m. on Monday, June 9, 1902.

The Stock will be allotted to the highest bidders, but no Tender will be accepted at a lower price than par.

By order,
THOMAS WADDOM, Secretary.

Offices: 35, Grainger Street West,
Newcastle-upon-Tyne, May 14, 1902.

HARTLEPOOL GAS AND WATER COMPANY.

IMPORTANT SALE OF GAS AND WATER STOCK.

TO BE SOLD by Auction, at the Com- pany's Offices, Middleton Road, West Hartlepool, on Thursday, June 12, 1902, at 3.15 p.m. precisely.

MR. J. W. CROSBY, AUCTIONEER.

£10,000
OF
HARTLEPOOL GAS AND WATER COMPANY'S FIVE PER CENTUM MAXIMUM ORDINARY STOCK,
AS FOLLOWS—NAMELY:

£5000 (Nominal) of the New Stock (Maximum Dividend 5 per cent.) authorized to be created and issued under the powers contained in the Company's Act, 1900.

£5000 (Nominal) of the New Stock (Maximum Dividend 5 per cent.) authorized to be created and issued under the powers contained in the Company's Act, 1898.

The above Stock will be entitled to Dividend from the 9th day of July next (if then fully paid-up), and will be Registered in the name of the purchaser without charge.

A deposit of 10 per cent. will be required to be paid at the time of sale, and the remainder on or before the said 9th day of July.

The Stock will be offered in Lots of £100 each.

By order of the Directors,
W. SCOTT, Secretary.

Hartlepool Gas and Water Co.'s Office,
West Hartlepool, May 8, 1902.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BOURNEMOUTH GAS AND WATER COMPANY.

NEW ISSUE OF 1000 £10 "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 3, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £10,000 ADDITIONAL "B" CONSOLIDATED STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 3, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
MAIDENHEAD GAS COMPANY.

NEW ISSUE OF £5000 CONSOLIDATED ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, June 3, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

NEW ISSUE OF 150 £10 "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 3, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 300 £10 "C" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 17, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Executors of Mrs. E. M. Harris, deceased.

ALDERSHOT GAS AND WATER COMPANY.

67 £10 FULLY-PAID "A" ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 17, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

TO THE SHAREHOLDERS.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices, 60, Gracechurch Street, London, E.C., on Tuesday, the 10th of June, 1902, at Twelve o'clock Noon, for the purpose of receiving the Report of the Directors and the Accounts for the Year ended the 31st of March, 1902, and for the transaction of the General Business of the Company.

One of the Directors, Mr. Arthur Matthews Paddon, retires from office, and offers himself for re-election.

The Auditors, Mr. Robert Hesketh Jones and Mr. Thomas Guyatt, retire, and offer themselves for re-election.

The TRANSFER BOOKS WILL BE CLOSED from the 27th of May until the day of the Meeting, both days inclusive.

By order,
A. W. COOPER,
Secretary.

60, Gracechurch Street, E.C.,
May 13, 1902.

DAMPFKESSEL-UND GASOMETER-FABRIK
(VORMALS A. WILKE & CO.)
BRUNSWICK, GERMANY.
MAKERS of GASHOLDERS & GAS PLANT.

ROBERT MARSHALL,
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Prices and Analysis of all the Scotch Cannels on Application.

HARDMAN & HOLDEN, LD.
ESTABLISHED 1820.
SULPHURIC ACID.

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If you want a first-class **JOINTING** for High or Low Pressure **MANHOLES, MUDHOLES, STEAM-PIPES, STEAM-CHESTS, CYLINDERS, GAS-ENGINES, WATER, CHEMICAL, HOT AIR,** or **FIRE** Joints, faced or unfaced, state your wants to us. Ask for No. 2 Catalogue.

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Telegrams: "EVANS, WOLVERHAMPTON." London Address: Salisbury House, London Wall, London, E.C. National Telephone No. 7039.

Please apply for Catalogue No. 8.

12,000 PUMPS IN STOCK AND PROGRESS.

TRADE MARK. LION EVANS WOLVERHAMPTON

NO TAPPETS.

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 806. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

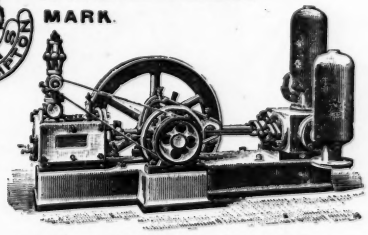

Fig. 688. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

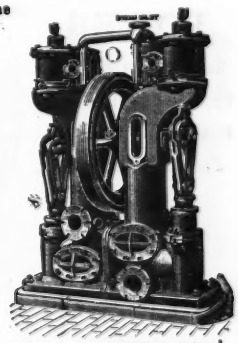

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
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FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
Also Removal of last Traces of
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in catch position.

Full Particulars on application to the Patentees:
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— LIMITED, —
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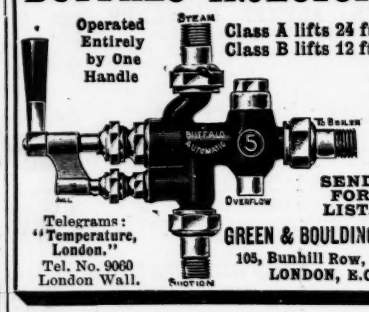
'BUFFALO' INJECTOR



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Class B lifts 12 ft.
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JAMES OAKES & CO.,
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AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
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MANUFACTURERS OF
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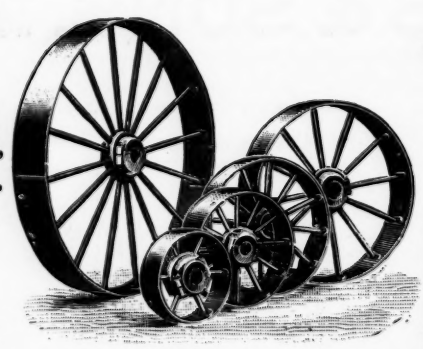

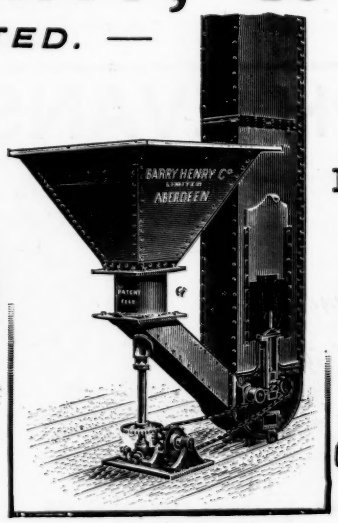

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TRANSMISSION OF MATERIALS.
Conveyors,
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